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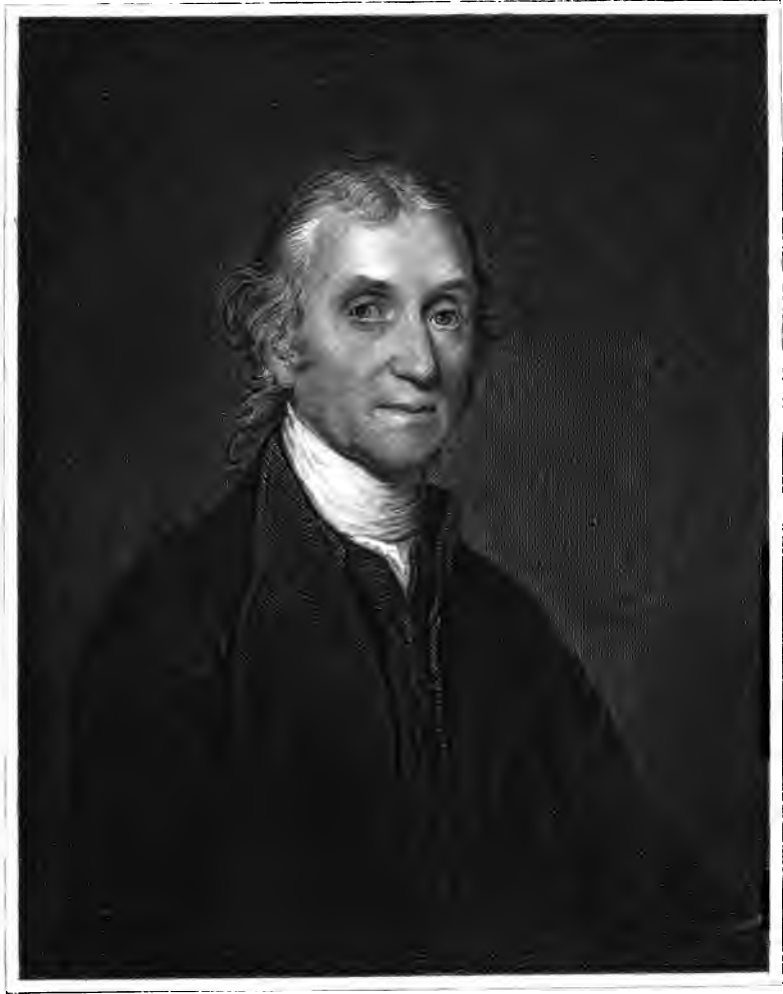
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*Joseph Priestley.*







# SCIENTIFIC CORRESPONDENCE

OF

# JOSEPH PRIESTLEY.

## NINETY-SEVEN LETTERS

ADDRESSED TO

JOSIAH WEDGWOOD, SIR JOSEPH BANKS, CAPT. JAMES KEIR, JAMES  
WATT, DR. WILLIAM WITHERING, DR. BENJAMIN RUSH,  
AND OTHERS.

TOGETHER WITH

## AN APPENDIX:

- I. THE LIKENESSES OF PRIESTLEY IN OIL, INK, MARBLE, AND METAL.
- II. THE LUNAR SOCIETY OF BIRMINGHAM.
- III. INVENTORY OF PRIESTLEY'S LABORATORY IN 1791.

EDITED, WITH

COPIOUS BIOGRAPHICAL, BIBLIOGRAPHICAL, AND EXPLANATORY NOTES,

BY

HENRY CARRINGTON BOLTON.

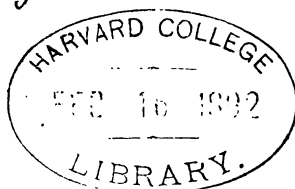
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1892.

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Mary Osgood Fund

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"IF WE choose one man as a type of the intellectual energy of the eighteenth century we could hardly find a better than JOSEPH PRIESTLEY, though his was not the greatest mind of the century. His versatility, eagerness, activity, and humanity; the immense range of his curiosity in all things, physical, moral, or social; his place in science, in theology, in philosophy, and in politics; his peculiar relation to the Revolution and the pathetic story of his unmerited sufferings may make him the hero of the eighteenth century."

FREDERIC HARRISON.



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# SCIENTIFIC CORRESPONDENCE

OF

## JOSEPH PRIESTLEY.

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### INTRODUCTION.

THE sources of information concerning the life of JOSEPH PRIESTLEY are numerous and detailed. His philosophical writings, his theological controversies, his liberal political essays, his notable discoveries in chemistry, and even his misfortunes in the Birmingham riots of 1791, that caused his eventual expatriation, kept him constantly before the public. Being both affectionately admired and cordially hated, persecuted by his own townsmen yet highly esteemed by continental savans, bitterly assailed by the public press and yet the frequent recipient of substantial testimonials of esteem from active and influential friends, contemporary publications portrayed his acts, his opinions, and his remarkable talents. Since his death many men of letters have placed on record their estimate of Priestley's philosophy, of his theological system, of his political tenets, and of his contributions to science; and, finally, every extended dictionary of biography and every encyclopædia, in three languages, for three-quarters of a century, has contained a sketch of his life and labors.

Although himself a voluminous writer, the modest autobiography which he left behind him is altogether too brief and scanty to satisfy posterity. His Memoirs were extended by his son, and this work was afterwards expanded to two volumes by Mr. John Towill Rutt, who added notes and

inserted several hundred letters written by Priestley to his friends.<sup>1</sup> Believing, as he did, that his reputation would be founded on his theological system, Priestley, in his *Memoirs*, has but little to say of his work in science; and Mr. Rutt, evidently sharing this view, adds nothing whatever which can extend or illustrate Priestley's reputation as a chemical philosopher.

Notwithstanding this abundant material, therefore, the historian of science looks for the most part to Priestley's published treatises for information as to his notable discoveries; and the diffuse style of giving results of experiments prevailing in his day makes the search a lengthened one. We do not overlook the fact that several lectures or addresses portray Priestley as a chemist, but these are compressed into the brief compass necessitated by the occasion of their delivery.

The ideal sketch of Priestley as an investigator in science is, we think, yet to be written; we do not attempt in the following pages to supply this want, but rather to contribute material for some future historian to use in such a work. The advantages afforded by letters to obtain insight into the very thoughts of their writer and to illustrate his character are acknowledged by all, and with this in view we have collected and annotated the correspondence which here follows.

With few exceptions, these letters are now published for the first time; and those that have been in print may be appropriately reproduced here, for the connection increases their interest and value.

<sup>1</sup> The originals of these letters are preserved in Dr. Williams' Library, Grafton St., London. Two folio volumes contain them bearing the title: "Original Letters from Dr. Joseph Priestley, F.R.S., to the Rev. Theophilus Lindsey, 1766-1803, and to the Rev. Thomas Belsham, 1789-1803." Vol. I. contains letters written in England, and Vol. II. letters written in America, with a Supplement. Another volume in this library contains: "Manuscript letters of Dr. N. Lardner, Dr. Priestley [and others], from the year 1761 to the year 1801. Addressed to the Rev. J. Wiche, Rev. T. Lindsey [and others]. Presented by Mrs. Benj. Marden to Dr. Williams' library, 1866." Thanks are due to the Rev. F. H. Jones, Librarian, for the privilege of examining these volumes.

To Mrs. Robert A. Wainewright of London, Dr. Priestley's only surviving<sup>1</sup> granddaughter, *née* Sarah Priestley, I am under great obligations for copies of forty-one letters which passed between Joseph Priestley and Josiah and Thomas Wedgwood. Mrs. Wainewright received these letters from her cousin Miss Finch (a granddaughter of Priestley), to whom they had been presented by the grandson of Josiah Wedgwood, Mr. Francis Wedgwood of Barlaston, Stone, Staffordshire. We shall allude to this collection again.

To William O. Priestley, M.D., LL.D., of London, I am indebted for copies of five letters, three written by Priestley to his sister Mrs. Crouch, one to Josiah Wedgwood, and one to Mr. J. Johnson, Priestley's publisher. The two latter were loaned to Dr. Priestley by Mr. Swann Hurrell of Cambridge, England, and were kindly copied by Mr. Joseph Priestley, barrister, of London.

To Mr. Swann Hurrell I am obliged for the opportunity of copying two letters presented by him to the University Library, Cambridge; one addressed to Mr. John Wilkinson, Priestley's brother-in-law, and one to Josiah Wedgwood (dated Nov. 22d, 1791).

During the preparation of this volume I have been so fortunate as to have the friendship of the eminent historian and antiquarian Sam: Timmins, Esq., J.P., F.S.A., of Birmingham. Mr. Timmins was the promoter of the memorial to Dr. Priestley which stands in so conspicuous a position in a crowded thoroughfare of the town, a full-length marble statue of the chemist in the act of discovering oxygen. Mr. Timmins has for many years paid much attention to local history, and especially to matters concerning Dr. Priestley, of whom he has frequently published essays. (Transactions of the Archæological Section of the Birmingham and Midland Institute.) To my friend I am indebted for many favors, and particularly for copies of fifteen letters belonging to his own valuable collection of autographs or to those of his

<sup>1</sup> Since writing these lines, the lady has gone to her rest. She died March 6th, 1891, in the 84th year of her age.

friends ; of these seven are addressed to Sir Joseph Banks, six to Dr. William Withering, one to Mr. Lee, attorney-at-law, and one is addressed to Priestley by Josiah Wedgwood.

To Mr. W. M. Vaughan of Cambridge, Mass., I am indebted for copies of four letters, three of which are addressed to his grandfather Benjamin Vaughan, and one to William Vaughan son of the latter.

Mr. Ferdinand J. Dreer of Philadelphia kindly loaned me from his valuable autographs, two letters, one addressed to Mr. John Vaughan (brother of Benjamin above named) and one to the Rev. Mr. Abercrombie of Philadelphia.

To Mr. James Keir Moilliet of Great Malvern I am much indebted for a copy of his privately printed Life of James Keir, from which I have taken the ten letters in this correspondence.

Professor Edouard Grimaux, of Paris, kindly sent me at my request a copy of a single letter from Priestley to Lavoisier, culled from the extensive collection of manuscripts and documents which forms the basis of Prof. Grimaux's valuable life of the great French chemist.

To Mr. George F. Kunz, of New York, I give thanks for a copy of a letter in his possession, addressed to Citizen Perigaux.

To Mr. Conyers Button, of Philadelphia, I am indebted for a copy of a memorandum which concludes this collection of letters.

To the Trustees and the Librarian of the Library Company of Philadelphia I am obliged for permission to copy the nine letters addressed to Dr. Benjamin Rush.

The four letters addressed to James Watt are taken from Muirhead's *Discovery of the Composition of Water* ; the letter to Franklin was read at the Northumberland Celebration of the Centenary of the Discovery of Oxygen, and published in the *Proceedings*. (Philadelphia, 1875, 4to.)

To the Trustees and Librarian of the Warrington Museum and Library I am obliged for a synopsis of the collection of letters from Priestley to Mr. Wilkinson, at the close of this work.

To all the persons and institutions named I express my cordial thanks for many courtesies, especially for responses to letters of inquiry, without which my labors had been vain.

A majority of the letters embraced in this volume are addressed to Priestley's scientific friends, and treat of scientific matters of mutual interest; on this account I venture to call the collection the Scientific Correspondence of Joseph Priestley.

#### THE PRIESTLEY-WEDGWOOD LETTERS.

The letters to Wedgwood are written for the most part on letter-paper measuring 18 x 24 cm. (7 x 9½ inches), though some of the larger ones are on paper 20.5 cm. x 32.5 cm. (8 x 12¾ inches). The paper is of course unruled, the letters are folded in the manner which obtained prior to the use of envelopes, and are sealed with red wax. Priestley used two seals, one about one-half inch in diameter, circular in shape and consisting of two simple lines surrounding a classical head; the other is larger, being an oval one inch by seven-eighths, and bearing his coat of arms with the motto, "*Aræ longa, vita brevis.*" Some of the impressions are nearly as fresh as when they left Priestley's hand one hundred years ago.<sup>1</sup>

The Wedgwood letters are folded lengthwise for the purpose of filing and are endorsed with the name "Dr. Priestley" and the date; this has evidently been done in part by Josiah himself, in part by his secretary, Chisholm, and on letters addressed to Thomas Wedgwood by the recipient. They are in good preservation with a few exceptions in which the paper is exceedingly tender as if it had been exposed to acid fumes in a laboratory.<sup>2</sup>

<sup>1</sup> Of one of these seals we have a silver electrotype, made by Tiffany & Co., which is a very admirable facsimile.

<sup>2</sup> The other letters of this work require no special description, not differing essentially from the Priestley-Wedgwood epistles.

Priestley's handwriting is fairly regular and generally very legible; here and there rough diagrams of apparatus are inserted.

With the exception of Nos. 34, 35, 64, 68, the letters which passed between Priestley and the two Wedgwoods were in the hands of Miss Eliza Meteyard, the biographer of Wedgwood, at the time she was engaged on her admirable works.<sup>1</sup> This is evident from references made by Miss Meteyard to the friendship existing between Wedgwood and Priestley, and to very brief allusions to this correspondence; it is further confirmed by the existence on the brown wrapping paper enveloping the package of letters, loaned to the writer, of the words "Miss Finch with Miss Meteyard's compliments," words obviously written on returning the bundle to the lender. Part of the correspondence is also referred to by Dr. George Wilson in his *Life of the Hon. Henry Cavendish* (London, 1851). Dr. Wilson makes some use of their contents in discussing the water-controversy. Only detached fragments of a portion of the letters, however, are quoted.

The previous references to these letters by no means detract from the interest attached to their present publication; they cover a period of thirteen years (1780-1792) and compose the whole of the extant correspondence between the chemist and the potter. They treat almost exclusively of scientific matters, and are written in the confiding spirit which characterized the friendly intercourse of the men of science. Priestley often sat down to write his friend while flushed with delight at the completion of a successful experiment, sometimes even before his crucibles had cooled; and feeling assured that his communications would be received by a sympathizing reader, he wrote his first impressions, his hopes, and his plans with a naturalness and self-portrayal pleasant to behold.

Dr. Priestley, while admitting his great indebtedness to the wealthy manufacturer of earthenware for frequent supplies of apparatus, shows his strong confidence in his friend's esteem by repeated requests for further favors, and at the same time shows great delicacy in accepting the gifts of money sent by

<sup>1</sup> *Life of Josiah Wedgwood*, London, 1865; and *A Group of Englishmen*, being Records of the Younger Wedgwoods, London, 1871.

Wedgwood to defray the extraordinary expenses of the philosophical experiments, and expresses his gratitude in terms which must have been most agreeable to his benefactor. (See Letter 33.)

The large number of letters published in Rutt's Life are almost wholly on theological and literary matters, and throw light only on that feature of their busy author; the Priestley-Wedgwood letters portray the philosophical and chemical side of this man of many talents. They chronicle from week to week and year to year the experiments and immediate deductions of the chemist, and it is no reflection on Priestley, that by the light of later discoveries it becomes easy for us to point out errors of fact and judgment. Priestley himself candidly admits in one of these letters that his power of observing phenomena is superior to his power of interpreting them aright, an admission borne out by his unyielding adherence to the phlogistic theory throughout his life.

We are by no means desirous of increasing the number of biographies of Priestley by our own labors, but a brief statement of the salient facts in his history previous to the date of these letters seems to be expedient in order to introduce the reader to them.

Joseph Priestley was born near Leeds, Yorkshire, in 1733, received a grammar-school education, showed great aptitude for acquiring languages living and dead, and studied divinity. At the age of 22, he became pastor of a small congregation of Unitarians at Needham, where he preached three years, and taught school to eke out his small salary of £30 per annum. He served three years more in a similar capacity at Nantwich, where his talents secured for him the chair of languages and belles-lettres at the flourishing academy in Warrington. This was in 1761, in the 28th year of his age. Here he remained six years, and "by the splendour of his talents he added greatly to the celebrity" of this institution. During this period he delivered lectures upon the Theory of Language, upon Oratory and Criticism, upon History and general Policy, and upon the Constitution and Laws of England, some of



which were afterwards published. He also published an *Essay on Government*, and a *Chart of Biography*. At Warington he married the daughter of a worthy iron-master, Isaac Wilkinson, and while residing here the University of Edinburgh conferred on him the honorary degree of LL.D., and upon the recommendation of Dr. Franklin, Dr. Price, and other philosophical friends, he was admitted a Fellow of the Royal Society. In 1767 he accepted the charge of a large congregation at Leeds, and here he continued another six years. During this period he was constantly writing and publishing on history, political economy, and theology.

Priestley had a predilection for natural science, and notwithstanding his many and diverse pursuits, undertook, at the suggestion of Dr. Franklin, a *History of the Discoveries in Electricity*. This he completed and printed in less than one year; it increased greatly his reputation. At Leeds, he began his enquiries into the subject of the various kinds of air, and announced the discovery of nitric oxide (1772). He also published "*Directions for Impregnating Water with Fixed Air*" (London, 1772), which attracted much attention. His reputation as a philosopher and scientist brought him an invitation from Lord Shelburne to reside with him at Bowood (near Calne, Wiltshire), as literary companion and nominal librarian. This he accepted, as the pecuniary terms were favorable to the support of his growing family, and he would enjoy abundant leisure for his researches. He was now forty years old, but it was not until a year later that he isolated oxygen gas and drew to himself the attention of the whole world of science. Free from pastoral cares he devoted himself to the chemistry of gases, discovering in rapid succession ammonia, hydrochloric acid, sulphurous acid, silicon fluoride, and nitrous oxide, afterwards known in Davy's time as "laughing gas." He published at intervals six volumes entitled "*Experiments and Observations on Different Kinds of Air*," which won for him the appellation, "Father of Pneumatic Chemistry." He remained seven years with Lord

Shelburne, and then removed to Birmingham, an event which he calls "the happiest of my life."

The first of the letters now published is dated, Calne, March 26, 1780, being a few weeks before his settlement in Birmingham. At this date Priestley was in the prime of life, had an established reputation at home and abroad as a chemical philosopher, and as a theological writer of fertility and zeal. He had published four of the volumes on *Different Kinds of Air*, and was engaged in printing the fifth. He continued to experiment in the laboratory and communicated the results to his friend Wedgwood in return for the generous supply of apparatus with which the latter favored him.

BRIEF NOTICES OF THE PERSONS TO WHOM THE  
LETTERS WERE ADDRESSED.

JOSIAH WEDGWOOD to whom a majority of these letters are addressed needs no introduction to our readers; his name is imperishably associated with the beautiful earthenware first produced by his skill. Wedgwood was born at Burslem in 1730 and was therefore three years older than his correspondent. His early education was very limited, being obliged to work in his elder brother's pottery. In 1759 he founded a manufactory of ornamental pottery, and ambitious to produce the finest articles, he conducted experiments which led to the invention of the ware known by his name. The beautiful character of the new ware and the artistic workmanship of the products of his establishment soon gained for him a high reputation. He caused copies to be made of antique vases, medallions, and sculptures which were of remarkable accuracy and exquisite beauty. His growing business caused him to establish large works near Newcastle-under-Lyme, which place he named Etruria, and to which the letters of this collection were addressed.

Wedgwood was no ordinary potter; his elegant products exerted a marked influence in refining the national taste, and his establishment was of positive benefit to the commercial prosperity of England.

As Wedgwood advanced in years he surrounded himself with literary and scientific treasures, and gradually made up for the deficiencies of his early education, paying much attention to scientific studies bearing upon his industrial pursuits. His acquaintance with men of science was a natural sequence.

The first letter of this correspondence bears the date November 30th, 1780: at this date Priestley and Wedgwood had already been acquainted eighteen years. They first met at the residence of Thomas Bentley in Liverpool, where Wedgwood was confined to the house by an accident to his knee, and his physician Dr. Matthew Turner brought in Priestley (temporarily in Liverpool) to see his patient. (Meteyard, I., 308.)

This was in the spring of 1762. Dr. Priestley had previous acquaintance with Mr. Bentley, who was one of the founders of Warrington Academy (1757), where Priestley was at this time a teacher. Priestley writes of Bentley as "a man of excellent taste, improved understanding, and a good disposition, but an unbeliever in Christianity which was therefore often the subject of our conversation." (Rutt, I., 60.)

Even when first introduced Priestley and Wedgwood were not strangers in name, and the latter had already discussed Priestley's discoveries in writing to Bentley. Indeed Bentley seems to have kept Wedgwood well informed of Priestley's work prior to the direct correspondence of the chemist and the potter. Subsequently, Wedgwood became much interested in Priestley's "Essay on a Course of Liberal Education for Civil and Active Life" (1765), and aided Priestley financially in publishing his works. (Meteyard, I., 391.)

On the occasion of Priestley's engagement with Lord Shelburne, Wedgwood wrote to Bentley: "I am glad to hear of Dr. Priestley's noble appointment, taking it for granted that he is to go on writing and publishing *with the same freedom* he now does, otherwise, I had much rather he still remained in Yorkshire." (Meteyard, II., 451.)

Thomas Bentley became in 1767-68 the partner of Wedgwood, and rendered important service in building up the vast establishment for producing the creations of Wedgwood's

genius. A strong attachment grew up between the partners, which continued throughout life. We have given these particulars of the intimate relations of these three men, because in the first letter of their correspondence Priestley condoles Wedgwood on the loss of his friend and partner Bentley. Bentley died Sunday, November 26th, 1780, and Priestley's letter was written four days later.

Wedgwood afterwards erected a tablet in Chiswick Church to Bentley's memory. This is figured in Meteyard's *Life of Wedgwood*. (Vol. II., 460.)

At the date of the first letter in the series Wedgwood's days of trial and poverty had passed; he had overcome the difficulties connected with his manufactures, and, except for the recent loss of his partner, was happy in his family life, his wealth, reputation, and influence. The intimate nature of the friendship between the correspondents the letters themselves will disclose; we shall intrude our own notes only so far as seems useful in explaining allusions to facts and to persons.

Five of the letters (Nos. 59, 66, 73, 75, 76) towards the close of the correspondence are addressed to Josiah's youngest son, Thomas. Thomas was born in 1771, and was consequently only twenty years of age when thus favored by Priestley's notice. Inheriting great wealth and enjoying but little robust health, Thomas had not the energy and industry of his father, though in other respects he was a worthy son. He possessed high ability and scientific tastes, and is credited by his friends with "unfolding the first germs of photographic art." The letters written him by Priestley show he was encouraged to pursue his researches by the eminent chemist.

**BENJAMIN VAUGHAN AND HIS BROTHERS.**—The friendship between Priestley and the Vaughan family dated back to the days when he taught school at Warrington. Mr. Samuel Vaughan, born in 1720 died in 1802, had four sons, Samuel Jr., John, Benjamin and William, and urged Dr. Priestley to receive the two latter into his family as boarding pupils. Dr. Priestley at first declined the proposal of Mr. Vaughan, but

afterwards consented and received the very moderate compensation of fifty pounds a year for each son (Rutt, I., 59). Dr. Priestley's action laid the foundation of a friendship that bound the families together throughout life.

Of the five letters in our work three are addressed to Benjamin, one to William, and one to John. Benjamin was born in Jamaica in 1751 and died at Hallowell, Maine, to which place he and his brother Samuel, Jr., had emigrated. Immediately after the Birmingham riots of 1791 William received Dr. Priestley into his house, showing as the latter writes "no small degree of courage and friendship." There Dr. Priestley dictated (his eyes being temporarily weak) to Mr. Vaughan's daughter an "Appeal" which he afterwards presented to her together with a valuable pin, set in pearls, and the word "Appeal" on the back. (Private communication from Mr. W. M. Vaughan of Cambridge, Mass.)

John Vaughan settled in Philadelphia and was long active in the American Philosophical Society, becoming its President.

Dr. Priestley frequently mentions the different members of the Vaughan family in his correspondence. Of Mr. Benjamin Vaughan he wrote, under date of Northumberland, Sept. 4, 1798: "He is a man that any country may be proud to possess, having for ability knowledge of almost every kind, and the most approved integrity, few equals. He is well known to, and frequently corresponds with the President. \* \* \* \* He has fixed his residence at Kennebeck because his family has large property there." (To Mr. Corbett, Rutt, II., 406.) In another letter Dr. Priestley remarks: "I should much rejoice to see Mr. B. Vaughan, but it would be very unreasonable to expect it. He would enter into all my views, theological or political." And he sends "his best respects to Mr. Vaughan, Mr. Freeman, and Mr. R. Vaughan." (Letter of Nov. 10, 1795, to Mr. Russell. Rutt, II., 321.)

MR. JOHN WILKINSON, to whom one of the letters is addressed, was one of Dr. Priestley's brothers-in-law. Of him Miss Meteyard writes as follows: "John Wilkinson and

his father Isaac played no unimportant part in the vast industrial movement of their time. Isaac invented and first brought into action the steam-engine blast at his iron-works near Wrexham; John, at the same place as also at Bradley Forge, in Staffordshire, executed all the ponderous castings for the steam-engines required in the Cornish mines, as well as those for Boulton and Watt when they first commenced business." (Life of Wedgwood, I., 317.)

Mr. John Wilkinson lies buried near Castlehead, in the township of Upper Allithwaite, Cartmel, Lancashire. His tomb is a pyramidical mausoleum consisting of twenty tons of iron, on which is inserted the following epitaph, written by himself:—

"Delivered from persecution of malice and envy here rests  
JOHN WILKINSON, Iron-Master, in certain hopes of a better  
state and heavenly mansion, as promulgated by Jesus Christ,  
in whose Gospel he was a firm believer. His life was spent in  
action for the benefit of man, and he trusts in some degree to  
the Glory of God."

Castlehead is a conical rock, and is supposed, from some imperial coins found there, to have once had a Roman inhabitant. Mr. Wilkinson, in adopting it for his abode, found many relics of antiquity, such as ancient rings, coins, fibulæ, beads, and other ornaments. These were preserved and labeled by Dr. Priestley and others, placed in the fine mansion built by Mr. Wilkinson for his residence.<sup>1</sup>

Of his brothers-in-law Dr. Priestley writes: "The favors I received from my two brothers-in-law deserve my most grateful acknowledgments. They acted the part of kind and generous relations, especially at the time when I most wanted assistance. It was in consequence of Mr. John Wilkinson's proposal, who wished to have us nearer to him, that, being undetermined where to settle, I fixed upon Birmingham, where he soon provided a house for me." (Rutt, I., 217.) This invitation of Mr. Wilkinson is mentioned by Priestley

<sup>1</sup> Edward Baines' History of Lancaster. Liverpool, 1824, vol. i., p. 596.

in a letter to the Rev. R. Scholefield, dated June 1, 1780. (Rutt, II., 335.)

WILLIAM WITHERING, M.D., F.R.S., born March 28, 1741, died October 6, 1799, was a physician, chemist, and botanist of eminence. He received his medical education at the University of Edinburgh, practised his profession eight years in Stafford, and was then called to Birmingham to succeed Dr. Small, who died in 1775. Here he pursued his original researches in botany and chemistry, publishing several essays and translations; he became a member of the Lunar Society and joined in the festive meetings of the learned members. His analysis of *Ærated Terra Ponderosa* established a new mineral species now called by his name, "Witherite." In 1784 he was elected to the Royal Society. During the Birmingham riots of July, 1791, Dr. Withering was forced to abandon his residence, Edgbaston Hall, but the arrival of military prevented its destruction. Failing health caused him to seek a milder climate, and he spent the winter of 1792-93 in Portugal, but with only slight advantage. His debility increased, but he lingered until October, 1799. His chief publication was entitled, *A Botanical Arrangement of all the Vegetables naturally growing in Great Britain*, 2 vols. 8vo., 1766, and a second edition in three volumes, 1787-92, and a third edition in four volumes, 1796. His *Miscellaneous Tracts*, with a *Memoir of his Life*, were published by his son in 1822. (London, 2 vols. 8vo.)

SIR JOSEPH BANKS, the distinguished botanist and traveler, was born in London February 26th, 1743. He received his education at Eton and Oxford and early developed a predilection for natural history. Soon after taking his degree he inherited an ample fortune and thenceforth devoted his energy to the advancement of science. Banks took part in or organized several expeditions to little known regions and brought back with him rich collections in natural history and abundant stores of knowledge; the first was to Newfoundland and

Labrador in 1766 ; the second was in Captain Cook's memorable three-years' voyage to the Sandwich Islands ; the third was to Iceland, returning by the Hebrides and Staffa, the wonders of which Banks was the first scientist to describe. In 1778 Banks was elected President of the Royal Society, a position which he filled for forty-two years with the greatest zeal ; during his term of office he succeeded in securing communications of the highest importance, in gaining accessions of persons of rank and talent, and in exciting the whole body to extraordinary diligence and activity.

Banks was created a baronet in 1781, invested with the order of the Bath in 1795, and received a multitude of other honors at home and abroad. His activity in promoting scientific research and geographical exploration was untiring. His purse was always open to the cause of science and his library to fellow-students of natural history. His publications were, however, comparatively few and of no startling importance. Sir Joseph died March 19th, 1820, aged 77, and bequeathed his valuable library and botanical collections to the British Museum.

JAMES WATT, the illustrious improver of the steam-engine, was born at Greenock on the 19th of January, 1736. When a youth ill health prevented his receiving the regular discipline of schools, yet seems to have led him to self-culture of his intellectual powers. He contended throughout life with a delicate constitution. After serving an apprenticeship to a mathematical instrument-maker he established himself in similar business in connection with the University of Glasgow. In this capacity he had occasion to repair a small model of Newcomen's steam-engine, and was thus led to investigate the use of steam as a motive power. His prime invention of the separate condenser was completed as early as 1765. From this date to 1773 he was engaged in important surveys and engineering works in Scotland. In the following year he joined Matthew Boulton of Soho, and from this partnership flowed most memorable results. Of their achievements in



developing steam-engines, in spite of great obstacles, much might be written. The partnership of Boulton and Watt terminated in 1800, when the latter retired from business and passed the remainder of his life quietly, but in the incessant pursuit of mechanics. He died August 19th, 1819.

Watt is one of the claimants for the honor of the discovery of the composition of water, information of which will be found in the ensuing correspondence. Of Watt's genial character and great intellectual powers some account will be found in the article on the LUNAR SOCIETY (*see* Appendix).

JAMES KEIR, F.R.S., Captain in the Royal Army, was born at Edinburgh, September 29, 1735. As his father died while James was very young, his mother took charge of his education; he attended the High School and the University, pursuing medical studies and enjoying the facilities which an ample patrimony afforded.

Having completed his medical studies he entered the army, and saw service in the West Indies where his medical skill was useful. After his marriage with Miss Harvey he left the army (about 1770) and went to reside in Birmingham. In 1775 he began business as a glass manufacturer, and a few years later took sole charge of the extensive works of Boulton and Watt at Soho. In partnership with Mr. Blair, a brother officer, he established near Dudley works for the manufacture of alkali and soap. To these were subsequently added litharge and other chemicals.

While at the University of Edinburgh he formed the acquaintance of Dr. Erasmus Darwin, and their friendship was strengthened by personal contact in Birmingham. Of his activity in the Lunar Society we have written elsewhere. Chemistry was always an attractive pursuit, and he contributed numerous articles to the Royal Society. He also translated Macquer's *Dictionnaire de chimie* into English, a work which extended his name and influence. He was the author of several ingenious processes in the manufacture of various chemicals, and the inventor of alloy almost identical with "Muntz-metal."

Captain Keir died October 11th, 1820, at the advanced age of eighty-five, and was buried in West Bromwich churchyard. His grandson James Keir Moilliet printed for private circulation (in 1868) a volume of Keir's life and correspondence, from which we have culled these few details. We express our thanks to Mr. Moilliet for a copy of the work.

THE REV. JAMES ABERCROMBIE, D.D., b. 1758, d. 1841, an eloquent and learned clergyman of the Episcopal Church in Philadelphia. He was prepared to enter the ministry when his eyes gave out and he turned to mercantile pursuits. Afterwards he became a teacher and then devoted himself to the ministry. He was regarded as one of the best readers of the period.

BENJAMIN FRANKLIN (1706-1790), the printer, journalist, philosopher, statesman, patriot and scientist is too well known to need even a brief biography in these pages. Of him Mirabeau wrote: "Antiquity would have raised altars to this mighty genius, who, to the advantage of mankind, compassing in his mind the heavens and the earth, was able to restrain alike thunderbolts and tyrants."

Priestley formed the acquaintance of Franklin in 1766 during one of his annual visits to London. There he met Dr. Watson, Mr. Canton, Dr. Franklin and other philosophers and electricians, by whose encouragement he was led to write the *History of Electricity* published in 1767. (See Rutt, I., 55 *et seq.*)

*Franklin's Estimate of Dr. Priestley.*—Benjamin Vaughan and Franklin corresponded, and in one of the letters from the latter to the former, written October, 1788, occurs this interesting reference to Priestley and his theological views: "Remember me affectionately," writes Franklin, "to the good Dr. Price and to the honest heretic Dr. Priestley. I do not call him honest by way of distinction, for I think all the heretics I have known have been virtuous men. They have the virtue of fortitude, or they would not venture to own their

heresy ; and they cannot afford to be deficient in any of the other virtues, as that would give advantage to their many enemies ; and they have not, like orthodox sinners, such a number of friends to excuse or justify them. Do not however mistake me. It is not to my good friend's heresy that I impute his honesty. On the contrary 'tis his honesty that has brought upon him the character of heretic."

BENJAMIN RUSH, the distinguished physician and philanthropist, was born near Philadelphia, December 24th, 1745. After being graduated at Princeton College he studied medicine at Edinburgh, London, and Paris. In the first-named city he attended the lectures on chemistry by the eminent Dr. Joseph Black. On August 1, 1769, Dr. Rush was elected to the chair of chemistry in the University of Pennsylvania, and thus has the distinction of being the first Professor of Chemistry in America. It was however as a teacher of medical science that he acquired the high reputation which survives him, possessing great learning and power of expression. He took a prominent part in public affairs, supporting the popular cause in the Revolution, and being one of the signers of the Declaration of Independence. He held at different times the important positions of surgeon-general of the army, treasurer of the Mint, and Vice-President of the Bible Society of Philadelphia. He was distinguished for industry, benevolence and piety. He was a well-known writer on medicine, philosophy, political affairs, etc., and had an extensive medical practice in Philadelphia. Dr. Rush died in April, 1813, leaving nine children.

On the arrival of Dr. Priestley in Philadelphia, Dr. Rush promptly welcomed him to his circle of friends, the more cordially as they had common views and sympathies in politics, science, and to some extent in theology. When Dr. Priestley settled in Northumberland the friendship was cemented by correspondence, a portion of which has been preserved.

## CORRESPONDENCE.

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No. 1.

PRIESTLEY TO BENJAMIN VAUGHAN.

CALNE,<sup>1</sup> 26 March, 1780.

DEAR SIR: I send you among a few others a copy of my *letters*<sup>2</sup> &c., for the sake of collecting such remarks as I may avail myself of in the page or two that remain vacant at the end of the Preface—I wish to see what you have written on the subject of *cause* and *effect*, but I dare say it will not clash with what I have written, at least materially—

I thank you for your repeated accounts of Ld. Shelburne,<sup>3</sup>

<sup>1</sup> Calne, Wiltshire, near Lord Shelburne's seat Bowood.

<sup>2</sup> "Letters to a Philosophical Unbeliever" which were written after reading Hume. Part I. was published in 1780 and Part II. in 1782. Both reached a second edition in 1787.

<sup>3</sup> William Petty, Earl of Shelburne and Marquis of Lansdowne (1737–1805), a statesman and liberal patron of learned men. He held the office of Secretary of State under Pitt and favored a conciliatory policy towards the American colonies. In 1782 he became Prime Minister, and the independence of the United States was recognized by treaty during his administration. He had one of the finest private libraries in Great Britain, the control of which was enjoyed by Dr. Priestley during his seven years' residence with the Earl. Of Lord Shelburne's disposition towards him Priestley wrote: "The greatest part of the time that I spent with Lord Shelburne I passed with much satisfaction, his lordship always behaving to me with uniform politeness and his guests with respect; but about two years before I left him I perceived evident marks of dissatisfaction, though I never understood the cause of it, and until that time he had been even lavish on all occasions in expressing his satisfaction in my society to our common friends. When I left him I asked

and am glad he is in so good a way—Last night I wrote him a short letter of congratulation on his recovery; but, in the present state of his mind with respect to me, I do not think that either that, or anything else I can do, will please.

I have been busy with some *experiments*, and among other things have satisfied myself that it is altogether without reason that M. Fontana,<sup>4</sup> and Dr. Ingenhousz<sup>5</sup> pretends that the reasons of good and bad nitrous air comes to the same thing in his method of applying the test. I am astonished, and provoked, at the little care with which some persons make experiments, and the confidence with which they report them.

I thank you for procuring me the *thermometers*, which came safe. They seem very well adapted to the purpose, provided they be sufficiently sensible.

Mr. Arden too observed, and I think the experiment very fairly tried, that *air* parts with its heat in *condensation*. I intend to repeat the experiment, with different kinds of air.

I wish you could get down with the *Letters* before the end of the week, as I may possibly want the copy when I come to

him if he had any fault to find with my conduct, and he said *none*." (Rutt, I., 206.) On leaving Lord Shelburne Priestley retired with an annuity of £150, and two years later his lordship invited him to return to his former position, but Priestley declined to leave Birmingham.

<sup>4</sup> Felice Fontana, b. Apr. 15, 1730, d. Jan. 11, 1805, Abbé and Professor of Physics at the University of Pisa. An industrious and ingenious investigator, the inventor of the nitric oxide eudiometer, and author of many original papers on pneumatic chemistry.

Priestley discusses his labors in each of the prefaces to the three volumes (2, 3, and 4) of his *Experiments and Observations on Air* (1776–79).

<sup>5</sup> Jan Ingenhousz, born 1730 in Holland, lived from 1767 in England where he died in 1799. A practitioner of medicine and investigator in chemistry; author of many original papers. A letter from Ingenhousz to Priestley is given in the Appendix to vol. iv. of his *Experiments and Observations on Air*. Priestley's special interest in Ingenhousz was aroused by the paper of the latter entitled: "On the degree of Salubrity of the Common Air at Sea, compared with that of the Seashore and that of Places far removed from the Sea." (Phil. Trans. 1780, 354.)

town. But I wait a letter from you before I determine about my journey.

My wife joins me in respect to you also.

Yours sincerely,

J. PRIESTLEY.

To BENJAMIN VAUGHAN, Esq.

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No. 2.

PRIESTLEY TO WEDGWOOD.

BIRM., 30th Nov., 1780.

DEAR SIR: I thank you for thinking of me on the melancholy occasion of your letter. By very few will Mr. Bentley<sup>1</sup> be more lamented, as, from so long an acquaintance, but few can be so fully sensible of his worth. In a few days I should have written to him, to give him an account of my situation here, and the progress I have made in another volume of experiments, which, if all be well, will go to the press in about a month.<sup>2</sup>

Few of my friends interested themselves so much as he did in the success of my philosophical pursuits, and I shall now feel myself less interested in them myself. For the pleasure of communicating our discoveries is one great means of engaging us to enter upon and pursue such laborious investigations. Indeed every friend we lose (and none of us have *many* so justly entitled to that appellation as Mr. Bentley was with respect to me) makes life itself of less value, and prepares us for leaving it with less regret.

You are very kind to inquire after my health.<sup>3</sup> It is, I

<sup>1</sup> Thomas Bentley, Wedgwood's partner and friend. See Introduction. A fine portrait of Bentley forms the frontispiece to the second volume of Meteyard's *Life of Wedgwood*.

<sup>2</sup> *Experiments and Observations in Different Kinds of Air*, vol. v., London, 1780.

<sup>3</sup> Dr. Priestley writes thus of his health: "I have never been subject to headaches, or any other complaints that are peculiarly unfavorable to

thank God, to all appearances, perfectly reëstablished, except that I cannot bear animal food, and feel in some respects a want of strength. But I have as good spirits, and am as capable of application as ever; and I am preparing to do more business in a philosophical way than ever, having a laboratory built on purpose, and everything nearly ready to go work with advantage.

No person wished more ardently than Mr. Bentley, that I should have the leisure, I now have the prospect of enjoying for the study of nature; and I had flattered myself that, in my present situation, I might, sometime or other, have been favoured with a visit from him.

I hope I shall not be deprived of the satisfaction of seeing you in his place, if it were only to indulge our mutual sorrow. I shall be entirely at liberty at the time you mention, and have a bed at your service.

With much respect, I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

P. S. I communicated your ingenious paper to Mr. Banks<sup>4</sup> and doubt not its being well received by the Royal Society. I

study. I have never found myself less disposed or less qualified for mutual exertions of any kind at one time of the day more than another; but all seasons have been equal to me, early or late, before dinner and after, etc.; and so far have I been from suffering by my application to study (which, however, has never been so close or intense as some have imagined), that I have found my health improving from the age of eighteen to the present time [1787]; and never have I found myself more free from any disorder than at present; I must however except a short time preceding and following my leaving Lord Shelburne, when I labored under a bilious complaint in which I was troubled with gall-stones, which sometimes gave me exquisite pain; but by confining myself to a vegetable diet I perfectly recovered." (Rutt, I., 342-343.) See also letter to Rev. T. Lindsey, dated Oct. 20, 1788; Rutt, II., 12.

<sup>4</sup> Sir Joseph Banks, here referred to, was not knighted until 1781. He was at the date of this letter President of the Royal Society and Wedgwood's paper was referred to him officially. See Introduction.

have two or three books of Mr. B.'s<sup>5</sup> which I shall dispose of as you direct.

To MR. J. WEDGWOOD, Greek Street,<sup>6</sup> Soho, London.

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No. 3.

PRIESTLEY TO WEDGWOOD.

BIRM. 26 May, 1781.

DEAR SIR: I must take the liberty to give you this trouble about the *earthen retorts* you were so good as to promise me, and of which I am in great want.<sup>1</sup> I am analyzing various earthy substances, especially to ascertain the pabulum of subterraneous fires, and have already made several experiments which throw great light upon the subject.

The common *blue slate* yields an amazing quantity of air, and is then a black glassy substance. A *sandstone* also that I find here yields air in considerable plenty, but it is just now in a white heat, and I cannot tell what the residuum will be.

I have also made some other experiments of considerable consequence since my return from London,<sup>2</sup> especially some that I think are decisively in favor of my theory of respira-

<sup>5</sup> "B" evidently refers to Bentley, not to Banks.

<sup>6</sup> Greek St., Soho, was the location of Wedgwood's extensive ware-rooms in London, opened in April, 1774. Dr. Erasmus Darwin wrote to Josiah Wedgwood Nov. 29, of the same year, offering his condolences on the death of Bentley. (Krause.)

<sup>1</sup> Retorts, crucibles, evaporating baths, and many other vessels for the laboratory had been supplied to Priestley by Wedgwood even before the former left Leeds in 1773. These articles of Wedgwood's manufacture were in demand by chemists in England and on the continent. A catalogue of them was issued in 1722. (Meteyard, II., 409.)

<sup>2</sup> Priestley was in the habit of spending one month every year in London; there he saw and heard a great deal, made additions to his library, and to his chemical apparatus. A new turn was frequently given to his ideas. New and useful acquaintances were formed and old ones confirmed. (Rutt, I., 55.)



tion,<sup>3</sup> against a series of papers by Mr. Lavoisier<sup>4</sup> in the last volume of *Parisian Memoires*;<sup>5</sup> but having hurt my hand, I write with difficulty. You will therefore [excuse] my adding nothing more at present but that I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

P. S. If there be any earthy substance that you wish me to examine in my way, especially such as you may suspect to be found in places where volcanoes abound, and that have not been exposed to heat already, I shall be much obliged to you if you will send specimens of them, along with the retorts.

The retort in which I heated the blue slate cracked before the experiment was over.

I beg my best respects to Mrs. Wedgwood.

To MR. WEDGWOOD, near Newcastle-under-Lyne.<sup>6</sup>

<sup>3</sup> See Priestley's views on Respiration in a paper to the Royal Society read Jan. 25, 1776, *Phil. Trans.* lxi., p. 226. "Respiration is a true phlogistic process." "Black blood contains more phlogiston than red blood."

<sup>4</sup> Antoine Laurent Lavoisier, b. Aug. 16, 1743, died on the guillotine May 8, 1794. The eminent French chemist, as author of the new chemical theory of combustion, opposed to the prevailing theory of phlogiston, was one of Priestley's most active rivals in chemical philosophy. He announced his doctrine that calcination and combustion are the results of the union of a highly respirable gas with combustible bodies in 1775, one year after Priestley had isolated oxygen. As is well known Priestley never accepted the new theory, but stoutly defended the phlogistic theory to the last.

<sup>5</sup> Sur la respiration des animaux et sur les changements qui arrive à l'air en passant par leurs poumons. *Mémoires de l'Acad. Sci. Paris*, 1777.

<sup>6</sup> Newcastle-under-Lyne (or, under-Lyme), was the seat of Wedgwood's extensive potteries.

## No. 4.

PRIESTLEY TO WEDGWOOD.

BIRM. 31 May, 1781.

DEAR SIR: The day after I had written to you I received the retorts you were so obliging as to send me very safe. They have no fault except that they are something too large in the belly to go into the aperture of my furnace, so that I am obliged to invert them before I can get them placed properly. However, they will answer for many purposes very well.

As I know your readiness to supply any of my wants of this kind, I shall take the liberty to beg a few more of different, but all smaller sizes, the largest not to exceed  $3\frac{1}{2}$  inches on the outside, and also a few in form of *tubes closed at one end*, not exceeding an inch in diameter inside, and 15 inches long. For several purposes these will be more useful than retorts, especially for the examination of small specimens, of which I have a considerable number.

Every stone that I have yet examined yields more or less of air in a state to support flame; but I shall give you a more particular account of this course of experiments when it is farther advanced.

I should inform you that Mr. Shore of Norton near Sheffield gave me ten guineas and said he should continue to contribute that sum annually to defray the expense of my experiments.<sup>1</sup>

<sup>1</sup> Mr. Samuel Shore was one of Priestley's numerous benefactors, who contributed either single donations or annuities to aid him in publishing his works and conducting his researches. Among those whom Priestley terms "regular subscribers" were Dr. Watson and his son, Josiah Wedgwood, and later his son Thomas, Mr. Moseley, Mr. Samuel Salte, Mr. Jeffries, Mr. Radcliffe, Mr. Remington, Mr. Strutt, Mr. Shore, Mr. Reynolds, Messrs. Galton, father and son, the Rev. Mr. Simpson, Dr. Fothergill, Dr. Price, Sir Theodore Jansen, Mr. Constable, and Sir George Savile. Many of these, if not all, contributed ten guineas annually; Wedgwood himself gave 25 guineas, making the handsome sum of about 200 guineas. Mrs. Rayner, Dr. Heberden, Dr. Withering, and Mr. Tayleur (see Letter No. 49), also sent him large sums at different

My hand is not quite well, so that it is painful to me to write.

With my best respects to Mrs. Wedgwood, I am, Dear Sir,  
Yours sincerely,

J. PRIESTLEY.

P. S. Pray have you not your operator?<sup>2</sup>

To MR. WEDGWOOD, at Hetruria,<sup>3</sup> near Newcastle under line.

[Endorsed.] Received June 1st.

times. Priestley on leaving Lord Shelburne lost half his income, and had intended making up the loss by taking pupils, but his friends believing him "well qualified to serve the interests of science" offered this pecuniary aid to relieve him of teaching. Priestley himself says of their generosity: "I thought it right to accept it and I preferred it to any pension from the court, offers of which were more than once made by persons who thought they could have procured one for me."

To the above list (which is not complete) should be added Mr. William Russell, who secured for him a present of 200 pounds from some of the "heads of the congregation" in Birmingham. Priestley says: "Without assistance I could not have carried on my experiments except on a very small scale and under great disadvantages," and refers with great candour to his expenses for housekeeping and for the education of his three sons and a daughter. (Rutt, I., 214-217.)

After the disastrous riots of 1791 Priestley received many handsome gifts and offers. Compare Letter No. 64.

Lord Brougham, in his *Lives of Philosophers of the Time of George III.* (London, 1855), Article, *Priestley*, criticises him severely for accepting pecuniary aid from his friends and says: "We find in his correspondence a painful thankfulness expressed, in anything rather than the language of a philosopher, to Mrs. Rayner and Mr. Lee for seasonable benefactions." After examining with care the frequent allusions in the Priestley-Wedgwood letters to the generosity of the latter, we believe that any unprejudiced person would dissent from this view; Dr. Priestley expresses his appreciation and gratitude in great simplicity and earnestness; confident of the friendship of his benefactor he does not for a moment dream of its limitation or interruption owing to the pecuniary relations existing between them.

<sup>2</sup> This question may refer to Mr. Alexander Chisholm, who entered Wedgwood's service as secretary and chemical assistant in the spring of 1781.

<sup>3</sup> Hetruria, the new title of the Ridge House Estate where Wedgwood had built his extensive potteries. The old classical dictionaries spelled it as given, but the H was afterwards dropped. For a view of Etruria see Meteyard's *Life of Josiah Wedgwood*, vol. ii., p. 129.

## No. 5.

PRIESTLEY TO WEDGWOOD.

BIRM. 26th June, 1781.

DEAR SIR: I have not yet received the last parcel of retorts, &c., you were so obliging as to send me, and it is necessary for me to inform you that, having this day examined those I received last, I find none that I cannot force my breath through, and some in great streams, as may be seen when they are plunged in water.<sup>1</sup> The material of the former small retorts seems to be better adapted to my purpose. They also bear the greatest heats that I can give them. I am sorry that they are all used, though I hope to good purpose. They had no fault but that they sometimes opened at the junction of the two pieces of which they were composed. Possibly their having been compressed in a mold would make them more compact, and therefore (if more care were used in joining them) they might still do better than any other. I also now think the *form* of them as convenient as any other, as I use them in something of a different manner.

You would oblige me, therefore, if you would order the *same molds* to be used as before, and that a fresh parcel may be sent me as expeditiously as possible. I know you will not blame my eagerness, as I am in the midst of a very interesting course of experiments, the result of which I flatter myself will not be displeasing to yourself.

The bottom of one of the retorts was yesterday quite eaten away by some *fluor*, which proves that it contains a *peculiar acid*,<sup>2</sup> and that is not, as I before concluded, the vitriolic acid that was the basis of it. There was nothing but the fluor itself, exposed to a great heat. The *Rowley rag*<sup>3</sup> of this

<sup>1</sup> The porosity of the earthenware retorts and tubes with which Priestley worked was one of the sources of errors into which he fell and afterwards himself perceived. Compare Letters Nos. 17, 18, and 26.

<sup>2</sup> Hydrofluoric acid had been obtained (in an impure state) by Scheele in 1771, ten years before.

<sup>3</sup> "Rowley-rag," a kind of basalt ascribed by Jukes to the Palæozoic. See Letter 8, note 2.

country melts to a substance not to be distinguished from the *shistos*, or *blue slate*, and gives air like it.

I cannot add more, but must conclude,

Yours sincerely,

J. PRIESTLEY.

P. S. I shall be obliged to you for a pound or two of *ground flint*<sup>4</sup> the next time you send me anything.

To MR. WEDGWOOD, Greek Street, Soho, London.

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No. 6.

PRIESTLEY TO WEDGWOOD.

BIRM. 22d July, 1781.

DEAR SIR: I am sorry I had not the pleasure of seeing you last week, and hope I shall not be so unfortunate the next time you come this way.

The last retorts you were so obliging as to send me were excellent. I mean the *white* ones, the *brown* ones cracked on applying heat to them, tho' I used all the precaution I could. Indeed *one* of the white ones did so too. Either these, or the first you sent me will answer very well. *Tubes* will generally do as well as *retorts*, and your servants may always know whether they will do, by plunging them in water, and endeavouring to blow thro' them.

It happened unfortunately that the retorts cracked when I had in them the *clay* and the *flint* from the Apalachian mountains<sup>1</sup> that you favoured me with. I shall be glad of a small quantity of each along with the *ground flint*.

<sup>4</sup> Flint grinding was an important operation in Wedgwood's works. He used Thomas Benson's process of grinding under water, and later Brindley's improved mill. (Meteyard, I., 149 *et seq.*)

<sup>1</sup> Wedgwood, in his efforts to improve the pottery and porcelain for which his establishment became famous, collected clays, earths, and minerals of unusual aspect in all parts of Great Britain and even in America. From the latter country samples of clays and minerals were brought by

I have not yet got any *basaltes* or *lava*, but am in hopes that some of my friends in London will succeed for me.

With the greatest gratitude for your many favours, I am,

Dear Sir, Yours sincerely,

J. PRIESTLEY.

P. S.—Could you send me a little Granate<sup>s</sup> with the other things.

To MR. WEDGWOOD at Hetruria, near Newcastle-under-Line.

Rec'd July 23d, 1781.

No. 7.

PRIESTLEY TO WEDGWOOD.

BIRM. August 8th, 1781.

DEAR SIR: I have been favoured with your obliging letter and also *two boxes* of retorts, &c., which came to hand only on Saturday last. The cover of the larger box was quite off, and ten of the retorts broke, most of them so as to be of no use at all. They were sent late at night, and I had paid the carriage (4 sh.) before I was aware of the accident. I suppose there is no remedy in the case. Mr. Boulton<sup>1</sup> says *you* will be more likely to get it than *I*. I shall, however, speak to the book-keeper here.

I do not know how to desire a reparation of the loss, but indeed I shall soon want them much. I have used two that were whole and find them very good, and yet those of the porcelain kind are more compact and better for some purposes.

Your specimens were very acceptable. The *basalte* is pre-

captains of merchant vessels on their return voyages. Clays from the Carolinas, Georgia, and Florida and varieties of spar were examined by him, and specimens were submitted to his friend Priestley who gave him useful hints concerning them.

<sup>s</sup> Granate, the old way of spelling garnet (*granatus*).

<sup>1</sup> Matthew Boulton, of Boulton and Watt. See "Lunar Society," in Appendix.

cisely the same thing with our *Rowley rag*. I had some from London as well as yours. The *lava* from Vesuvius gave a good deal of air, but before the process was over, the retort cracked. The remainder of the specimen I put into a retort I particularly valued, it having sustained the greatest heat I can give it three times before; but it cracked presently this time, an accident I lament much. It was peculiar to both these experiments with the lava, that I found the retort when cold broke into many pieces, as if by the expansion of the matter in cooling. It is a perfectly black glass.

The *toadstone*<sup>2</sup> yields much air and becomes a black glass also. Mr. Keir<sup>3</sup> however thinks that even the basaltes may have been in fusion, and that, tho' a perfect glass at first, it might become the substance it now is by *length of time*. What think you of this? I mean to try what a heat of a week or two will do. Are your fires at all convenient for an experiment of this kind?

If you could favour me with another piece of the same kind of *lava*, I should value it much. It resembles a *stone*, and not a *cinder*. The latter do not so well answer my purpose.

The *granate* gives a good deal of air, and at the last pretty pure; as also was the last from the lava; for the retort, by some means or other, closing before the process was over, I got both the first and the last produced. I think a great deal would have been given.

Yours sincerely,

J. PRIESTLEY.

P. S.—Please to direct the next parcel to Wm. Russel,<sup>4</sup>

<sup>2</sup> "Toadstone," the Derbyshire name for a soft earthy variety of trap. See Letter No. 8, note 2.

<sup>3</sup> Capt. James Keir. See Introduction.

<sup>4</sup> William Russell, of Birmingham, with whom Priestley had become recently acquainted, remained his steadfast friend in prosperity and adversity. Mr. Russell gave him a refuge after the riots of 1791, and followed Dr. Priestley to America in August, 1795. (Rutt, I., 216 and *passim*.) See Letter No. 90, to Mr. William Vaughan.

Esq., with (P) under the name. It will come readier and cheaper. I do so with all my parcels from London. I hope you have used the *furnace*.

TO MR. WEDGWOOD, Etruria, near Newcastle-under-Line.

[Endorsed] Rec'd August 9th.

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No. 8.

PRIESTLEY TO WEDGWOOD.

BIRM. 18th Aug., 1781.

DEAR SIR: I can only most heartily thank you for your great readiness to make up the loss of the *retorts*. In due time I hope to receive them, and then hope to give a satisfactory account of them. The last that I used was No. 5 and a better cannot be made. It bore my greatest heat, gave no air of itself, and that which was expelled by heat was not at all contaminated. I therefore think that nothing can be more perfect in its kind. But I shall note any difference that I may happen to observe in the others.

The coals are to be put in at the great opening in the top of the *furnace*, and afterwards covered with *two bricks*. The openings in the sides are for *retorts*. The *screws* are of no use, and the iron plates that now cover the holes are only for *plugs* to stop the holes when they are not used for that purpose. There should be laid upon them a quantity of the same materials that line the inside of the furnace. But finding these plugs inconvenient, I only put stones into the holes, and plaster them on the outside with sand and clay. I have found it necessary to build the chimney more than twice as high as I found it.

Since I wrote the above the *box* and *cont.* are come safe to hand, and nothing in the least damaged. I value the contents very much, and in time shall not fail to give you the best account I can of all the specimens you have favored me with.

It is of some consequence to determine whether the *lava*



comes out of the volcano in the *stone-like* state in which we now find it, or acquires its present consistence of power and of yielding air afterwards. I hope to find this, and I can have the use of a glass-house fire for the purpose, of which I hope to make good use, as well as of my own.

• Your *fact* from Dr. Solander<sup>1</sup> is very curious and valuable.

Whatever the *basalt* is, the same is the *Rowley rag*, and similar to it *may* be the toadstone, and perhaps as you conjecture even *granate*, and many other substances.<sup>2</sup>

My friend Mr. Russel goes to Brighthelmstone<sup>3</sup> on Monday night, and has persuaded me to accompany him. I hope it

<sup>1</sup> Karl Daniell Solander (1736–1782), a naturalist of Swedish birth and British residence. He accompanied Sir Joseph Banks on Captain Cook's voyage around the world; published on geology and botany.

<sup>2</sup> "Toadstone" and "Rowley-rag," several times named in these letters, were described and analyzed by Dr. Withering in a paper read to the Royal Society May 16, 1782, and communicated by Joseph Priestley. Dr. Withering describes Rowley-rag from southern part of Staffordshire thus: "In appearance dark gray, with minute shining crystals; exposed to weather gets an ochry color on the outside; strikes fire with steel; cuts glass; melts though not easily under the blowpipe; heated in open fire becomes magnetic." The analysis he reports as follows:—

Pure siliceous earth	. . . . .	47½
Pure clay free from fixable air	. . . . .	32½
Iron in a calciform state	. . . . .	20
		<hr/>
		100

The toadstone from Derbyshire is described thus: "Dark brownish gray, granulated texture, with several cavities filled with crystallized spar. It does not strike fire with steel; it melts to a black glass."

Analysis —

Siliceous earth	. . . . .	56
More siliceous earth	. . . . .	7½
Calciform iron	. . . . .	16
Calcareous earth	. . . . .	7½
Earth of Allum	. . . . .	14½
		<hr/>
		101½

The paper is dated October 1, 1781 (Phil. Trans. 1782, 327).

<sup>3</sup> Brighthelmstone, now called Brighton, Sussex.

will contribute to the perfect restoration of my health. I shall return in less than a month. In passing through London, I propose to stay about a week. If I meet with anything in the philosophical way, you shall hear of it.

With the greatest gratitude and respect,

I am, Dear Sir, yours sincerely,

J. PRIESTLEY.

MR. WEDGWOOD, Etruria, near Newcastle-under-Line.

No. 9.

PRIESTLEY TO WEDGWOOD.

BIRM. 6th March, 1782.

DEAR SIR: Having made an experiment which I think will give you pleasure, I take the first opportunity of acquainting you with it.

I throw the focus of a burning lens on some *calx of lead* (out of which the air has been expelled) when confined in *inflammable air*. The air is rapidly absorbed, lead is formed, and what remains of the air is as inflammable as before.<sup>1</sup> This simple experiment seems to prove, that what we have called *phlogiston*<sup>2</sup> is the same thing with *inflammable air in a state of combination with other bodies*, just as fixed air is contained in chalk. From 40-ounce measures of air I received about 5 dwts. of lead. The inflammable air was got from iron by oil of vitriol.

<sup>1</sup> Priestley here records the important fact of the reduction of metallic oxides by hydrogen, but his interpretation of the phenomena is in accordance with the phlogistic theory to which he unhesitatingly adhered throughout his life.

<sup>2</sup> "Phlogiston," according to Stahl, was the principle of inflammability, but later it came to signify the principle common to all those bodies which left in contact with the air lessened its power of supporting animal life and flame. The belief, here announced by Priestley, of the identity of phlogiston and inflammable air (hydrogen) was first proposed by Cavendish, and strongly urged by Kirwan. (See Letter No. 10, note 4.)

I have made a similar experiment with charcoal, proving that common air becomes phlogisticated by a combination of inflammable air with it.<sup>3</sup> And I have also succeeded in making *nitrous air* from *nitrous acid*<sup>4</sup> and *inflammable air*. I am pursuing the experiment farther, as I have opportunity; but I want sunshine, and for that I must wait.

I am ashamed to be so troublesome, but another cargo of the *smallest sized retorts* No. 5 would be very acceptable and useful to me, as also the vessels you make of the same materials with your *mortars* that you supplied Mr. Boulton with. I should like mine to be 12 inches high and about  $1\frac{1}{2}$  inches or 2 inches in the inside. They are to stand in a sand heat. Pray would they bear a red heat? If they would, they would be excellent for many purposes. I want much something that will hold alkalis in fusion; but am afraid no such thing can be got.

I expect to be in London in about a month, and should be happy to meet you then. With gratitude for all your favours, I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

To MR. WEDGEWOOD, Hettruria, near Newcastle-under-Line, Staffordshire.

<sup>3</sup> This is not the place for a discussion of the phlogistic theory, but a brief explanation of the terms currently used by Priestley may be useful to some of our readers. Priestley regarded common air as a compound of phlogiston and oxygen, or as he called it "dephlogisticated air," i. e., air deprived of phlogiston. The other constituent of common air, nitrogen, he regarded as air saturated with phlogiston, hence called "phlogisticated air." He thought all combustible bodies contained hydrogen, and he was inclined to the belief that hydrogen and phlogiston are identical, as above stated. Regarding the different gases as varieties of air, Priestley used the following nomenclature: "fixed air" for carbonic acid gas (carbon di-oxide); "nitrous air" for nitric oxide; "alkaline air" for ammonia; "inflammable air" for hydrogen and in part for carbon monoxide mixed with marsh gas or alone; besides the terms for oxygen and hydrogen above given. In the cumbersome language of the phlogistic theory "decomposition of air in conjunction with inflammable air" signifies the union of air and hydrogen, which was usually effected by the electric spark.

<sup>4</sup> "Nitrous acid" signifies in modern language nitric acid.

## No. 10.

PRIESTLEY TO WEDGWOOD.

BIRM. 21 March, 1782.

DEAR SIR: I have received your obliging letter containing your generous contribution, and that of Dr. Darwin, to the expences of my experiments.<sup>1</sup> Whatever be my *success*, with such assistance I should be much to blame if my *zeal* and *assiduity* should be wanting.

Since my last I have found that *alkaline air* reduces the calx of lead with as much ease as *inflammable air*, and I think in greater quantity.<sup>2</sup> This you will think a very extraordinary fact; but it agrees with several of my former experiments, and throws great light upon them, and other things in the theory of chemistry; especially by converting alkaline air into inflammable air by the electric spark, the production of volatile alkali from iron superphlogisticated, and the affinity of all acids both with alkalis and phlogiston, which appear to be modifications of each other. However, when the calx has absorbed all the alkaline air that it can, there is a large residuum of phlogisticated air, whereas what remains of the inflammable air is unchanged; which seems to prove that the inflammable air is the more simple principle of the two.

Other remarkable facts have occurred in the course of these experiments; but as I want *sunshine* to ascertain them, I shall not trouble you with the mention of them at present.

I thank you for the communication of Dr. Darwin's note, and shall write him on the subject.

Before my late experiments phlogiston was indeed almost given up by the Lunar Society,<sup>3</sup> but now it seems to be re-estab-

<sup>1</sup> See Letter No. 4, note 1.

<sup>2</sup> Alkaline air, or ammonia, had been obtained in the gaseous state by Priestley in 1774. This experiment, as he justly remarks, throws great light on known phenomena. He is mistaken as to the reduction being effected more easily, but right in concluding that inflammable air is a "more simple principle" than alkaline air.

<sup>3</sup> See "The Lunar Society" in Appendix.

lished. Mr. Kirwan,<sup>4</sup> in a letter I have received from him this day, says that he has given in a paper to the R. Society, to prove, from my former experiments, that phlogiston must be the same thing with inflammable air, and also that dephlogisticated air and phlogiston make fixed air. This last I much doubt.

I could say much more; but as I hope to have the pleasure of seeing you soon, I am, with my respectful compliments to Mrs. Wedgwood, and your son, Dear Sir,

Most sincerely yours,

J. PRIESTLEY.

P. S. I thank you for the retorts, which I hear are arrived. Mr. Boulton had mentioned to me your curious and valuable thermometer.<sup>5</sup> It will be very useful to me, and many other persons.

To MR. WEDGWOOD, Greek Street, Soho, London.

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No. 11.

PRIESTLEY TO FRANKLIN.

BIRMINGHAM, June 24th, 1782.

DR. BENJAMIN FRANKLIN :

DEAR SIR: You have made me very happy by your letter, as I find by it that notwithstanding the unpleasant state of

<sup>4</sup> Richard Kirwan, F.R.S. (1735–1812), the distinguished Irish mineralogist and chemist. He was the champion of the view that phlogiston and hydrogen are identical and developed it in his "Experiments and Observations on the Specific Gravities and attractive Powers of various Saline Substances," a paper presented to the Royal Society in 1781, and followed by a supplement with the same title in 1782. It is to this second essay that Dr. Priestley refers.

<sup>5</sup> The first mention in this correspondence of Wedgwood's newly invented Pyrometer for measuring high temperatures. On May 9, 1782, Wedgwood's first paper was read to the Royal Society by Sir Joseph Banks: "An Attempt to make a Thermometer for measuring the higher degrees of Heat from a red Heat up to the strongest that vessels made of Clay can support." (Phil. Trans. 1782, 305.) For construction of the Pyrometer see also Black's Lectures on Chemistry, London, 1803, I.

politicks, your usual humour and pleasantry has not forsaken you. I am only concerned that you have not mentioned the case of my friend *Mr. Russell*,<sup>1</sup> about which I wrote you so particularly. But I have taken the liberty to assure him that, notwithstanding this omission, I am as confident that you have not neglected the business as if you had given me the most expressed assurance of it. One line, however, informing me what you think of the case will give me great satisfaction.

Having at length got *sunshine*, I am busy in prosecuting the experiments about which I wrote to you, and shall soon draw up an account of them for the Royal Society.

Please to inform the Duc de Rochefoucauld,<sup>2</sup> whose civilities to me I remember with pleasure, that my experiments are certainly inconsistent with Mr. Lavoisier's supposition of there being no such thing as phlogiston, and that it is the addition of air, and not the loss of anything that converts a metal into a calx. In their usual state calces of metals do contain air, but that may be expelled by heat, and after this I reduce them to a perfect metallic state by nothing but inflammable air, which they imbibe *in toto*, without any decomposition. I lately reduced 101 ounce measures of this air to two by calx of lead, and that small remainder was still inflammable. I explain Mr. Lavoisier's experiments by supposing that *precipitate per se* contains all the phlogiston of the metal mercury, but in a different state; but I can show other calces which also contain more phlogiston than the metals themselves. That mercury in its metallic state does contain phlogiston or inflammable air, is evident from the production of nitrous air by the solution of it in spirits of nitre, and I make *nitrous air* from nothing but *nitrous vapor* and inflam-

<sup>1</sup> See Letter No. 7, note 4.

<sup>2</sup> François Alexandre Frédéric de la Rochefoucauld-Liancourt, the liberal French peer and philanthropist (1747-1827), was at this time visiting America. His "Travels in the United States of America" were published, in 8 vols., in 1800, and contain statements about Pennsylvania, which Priestley's son Joseph pronounces "false and injurious." (Memoirs I., 172.)

mable air; so that it indisputably consists of these two ingredients. I have already ascertained the proportion of inflammable air that enters into the composition of lead, tin, copper, and silver, and am proceeding to the other metals as fast as I can. When the whole is completed I shall give you a further account of it.

I am exceedingly concerned to find that it is so difficult a thing to make *peace*; but I hope before the campaign is over all parties will have had enough of *war*, and be sensible that they will gain nothing by continuing it. If I had any voice in the business, the prospect of seeing you in this country would be a strong additional motive to accelerate the negotiations.

With the greatest respect and every good wish,  
I am, dear sir, yours sincerely,

J. PRIESTLEY.

P. S.—If you should think it proper, I have no objection to your sending a copy of my former letter to *Rosier's Journal*,<sup>3</sup> as a general outline of what I am doing. I wish to have every new fact to be as speedily and as generally known as possible.

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No. 12.

PRIESTLEY TO WEDGWOOD.

BIRM., 16 Sept., 1782.

DEAR SIR: As you are pleased to interest yourself so much in my philosophical pursuits, I flatter myself it will be agreeable to you to be informed that I have of late been very busy, and very successful.

The late sunshine, of which I hardly lost a single hour, has given me an opportunity of ascertaining beyond all doubt the

<sup>3</sup> Observations et mémoires sur la physique, sur l'histoire naturelle et sur les arts et métiers. Par l'Abbé Rozier. Paris, 1771-1822. An important early periodical devoted to science.

identity of phlogiston and inflammable air; but I have not succeeded so well as I expected in ascertaining the *quantity* of inflammable air that enters into the composition of all the metals, because the heat of the lens is capable of decomposing iron, and some other metals. Also, though I made *bismuth*, and regulus of *Cobalt* I cannot make *zinc*, or regulus of *arsenic*, or of *antimony*, except in alkaline air. I made *sulphur* readily, by evaporating oil of vitriol to dryness in inflammable air. It incrusts all the sides of the glass vessel in which the experiment is made.

It will perhaps surprise you to be informed, that the heat produced by this lens reduces the whole of charcoal (perfectly made) to inflammable air, without the least particle of fixed air in it.<sup>1</sup> The ashes are so little as not to be discerned.

I have also completely proved that the *electric matter*, is, or contains, phlogiston, by taking the electric spark in common air confined in a glass syphon by spirit of salt:<sup>2</sup> for in these circumstances the air is diminished and phlogisticated, though no metal, as before, was contiguous to it. When I use oil of vitriol or spirit of nitre, in this manner, I get an additional quantity of air, and this is all dephlogisticated air, being produced from the pure acids faster than the electric matter can injure it. I never before produced this air, except when the acids were previously combined with some earthy base. It seems therefore to prove that *pure air* is *pure acid* in another form, perhaps with the addition of latent heat. When I use the phosphoric acid, the common air is first phlogisticated, and then is increased by an addition of inflammable air. I shall pursue these experiments much farther.

I have been measuring heats in this town by your excellent method. My usual white heats, I find have been 136, that of the heat when cast-iron nails are made is 139, and the greatest we can ever raise on purpose being 142. Twice the clay and

<sup>1</sup> Priestley at first confounded hydrogen and carbon-monoxide, both being for him "inflammable air." It was not until 1799, when living in Northumberland, Pennsylvania, that he recognized carbon monoxide as a distinct gas. (Kopp, *Geschichte der Chemie*, I., 241.)

<sup>2</sup> Hydrochloric acid gas.



car were both melted and reduced to one shapeless mass; but we could not do it again, and there imputed it to something it came in contact with in the fire. I have yet to try the heat used in casting steel. I wish much to know how you ever reached 160.<sup>3</sup> I am told that your clay melts in the focus of Mr. Parker's lens;<sup>4</sup> and that for such heats as these *magnesia* will probably be better. I cannot melt the smallest bit of your clay with my lens.

I have much enlarged my apparatus, and should be particularly happy to show you my laboratory in its present state.

With my best respects to Mrs. Wedgwood, I am, Dear Sir, with gratitude and esteem, Yours sincerely,

J. PRIESTLEY.

P. S.—I have made a pretty remarkable experiment in the melting of malleable iron in pure air. Many circumstances are curious. I can only say here, that the iron is afterwards a perfect *glass*, not affected by acids.

MR. WEDGWOOD, Etruria, near Newcastle-under-Line, Staffordshire.

<sup>3</sup> Wedgwood's pyrometer had a scale divided into 240 degrees, each of which he calculated to be equal to 130° of Fahrenheit's scale, and the zero of his scale indicating a red heat corresponded according to his experiments to 1,077° Fah. But Wedgwood's instrument enormously exaggerated temperatures, giving figures (when referred to Fahrenheit) nearly ten times higher than those of Daniell.

It was not until May 13, 1784, however, that Wedgwood sent to the Royal Society his second paper entitled: "An Attempt to compare and connect the Thermometer for Strong Fire described in vol. lxxii. of the Philosophical Transactions with the common Mercurial ones." (Phil. Trans. 1784.) Two years later Wedgwood read a third paper under the title: "Additional Observations on making a Thermometer for measuring the higher degrees of Heat." (Phil. Trans. 1786, 390.)

<sup>4</sup> Mr. W. Parker, manufacturer of cutglass and maker of philosophical instruments, at 69 Fleet Street, generously supplied Priestley with every instrument he wanted in glass. One of his lenses was sixteen inches in diameter (Rutt, I., 216) and was in constant use by Priestley, who brought it with him to America. The lens was deposited for safe-keeping in the Smithsonian Institution and was unfortunately destroyed when a part of the building was ravaged by fire in 1865.

Priestley refers again to Mr. Parker in Letters Nos. 43 and 66.

## No. 13.

PRIESTLEY TO WEDGWOOD.

BIRM. 10th Oct., 1782.

DEAR SIR: When I received your favor I was just about to try the *dephlogisticated marine acid*,<sup>1</sup> and I find that the electric matter transmitted through it affects the air in the very same manner as when metal wires are employed, diminishing and phlogisticating it; so that there hardly remains any doubt but that the electric matter *itself* must contain the phlogiston with which the air becomes saturated.

Your observations on zinc, arsenic and antimony, are certainly very just, and account very well for the failure of my experiments with those semi-metals. I want sunshine for the prosecution of my experiments on *charcoal*. Pitcoal, I perceive, will leave more ashes than wood, and calcined bones a much greater proportion still.<sup>2</sup>

I am exceedingly pleased with Mr. Playfair's<sup>3</sup> method of reducing the scale of your thermometer to that of Fahrenheit. I think it cannot fail to answer, provided due precautions be taken in conducting the experiments, and those you mention are certainly very important ones. As the light acts upon one surface only, the pieces should be turned, and exposed on all sides. I suspect, however, that it will be impossible to be very accurate if you go very near the focus, and therefore it should be tested with Mr. Parker's lens. I have also sometimes thought that the heat increases in a greater proportion

<sup>1</sup> "Dephlogisticated marine acid" is, in the phlogistic nomenclature, the simple body now known as chlorine.

<sup>2</sup> The composition of bones, chiefly calcium phosphate, was discovered by Scheele, or Gahn, in 1771. This must certainly have been known to Priestley, who took great interest in Scheele's researches and encouraged Dr. J. R. Forster to translate and publish Scheele's "Chemical Observations and Experiments on Air and Fire," London, 1780. This work is dedicated to Priestley, and concludes with a letter by him.

<sup>3</sup> Probably John Playfair (1748-1819), afterwards Professor of Mathematics and of Natural Philosophy at the University of Edinburgh. For the correspondence between Wedgwood's and Fahrenheit's scales see note 2 to Letter No. 12.

than the increase of the square of the diameter of the pencil. But that should be ascertained by common thermometers in the first place, and then it would be as easy to compute on one proportion of increase as another.

I have heard that *magnesia*, pressed into a cubic form, was diminished in bulk by Mr. Parker's lens more than any substance whatever, and it retained its form without fusion.

You have heard of a pretended transmutation of quicksilver into gold by Dr. Price.<sup>4</sup> Yesterday I had a letter from Mr. Kirwan, who, after some account of it, adds: "But I have lately seen him and he has owned, that he believes that he was deceived, and that his mercury previously contained gold: that he bought it from the makers of *Or moulu*, &c. I said so much to him, that he is now satisfied to pass only for a mere able extractor of gold, and says he uses a preparation of *arsenic*, of which I persuaded him to promise he would give a paper to the Royal Society."

If you have not heard this before you will like to have the information.

I beg my respects to Mrs. Wedgwood and your sons, and am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

<sup>4</sup> James Price, M.D., F.R.S., a wealthy and learned physician of Guilford (1752-1783), greatly surprised the world of science by announcing in 1781 he had discovered a powder capable of transmuting quicksilver into gold. In 1782 he gave public exhibitions of the operation in his laboratory, and published a volume with the title: "An Account of some Experiments on Mercury, Silver and Gold made at Guilford in May 1782, in the Laboratory of James Price, M.D., F.R.S., Oxford, 1782." Many learned and influential men testified to the alleged transmutations, and the Royal Society became interested to examine Dr. Price's pretensions. The Society appointed the well-known chemists Kirwan (see note 4 to Letter No. 9) and Higgins to investigate. To the results of Kirwan's study Dr. Priestley here refers. In August of the following year Dr. Price, being pushed to disclose his methods or to confess his fraud, committed suicide by drinking cherry-laurel water in his laboratory, to which certain members of the Royal Society had come to witness experiments. (*Gentleman's Magazine*, 1791, 894.)

I have just seen an American gentleman, who left Dr. Franklin three weeks ago. He says he breaks very fast, and thinks he will not survive many months.<sup>5</sup> He says he only wishes to see a peace concluded before he dies. Mr. Laurence told this gentleman that he hoped there would be a peace in the course of this winter.<sup>6</sup>

MR. J. WEDGWOOD, Newcastle-under-Line.

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No. 14.

PRIESTLEY TO WEDGWOOD.

BIRM. Dec. 8, 1782.

DEAR SIR: I have had considerable success in my experiments since I had the pleasure to write to you last; but I was unwilling to trouble you with an account of *details*, or things of small consequence. I think, however, it will give pleasure to be informed that I have succeeded in converting pure *water* into *permanent* air<sup>1</sup> by previously combining it with quicklime, and then subjecting it to a strong heat. This air has a small proportion of fixed air in it, but the bulk of [it] is air a little worse than that of the atmosphere.

I had no certain expectation of this event; but was led from various considerations to try the result of exposing to a

<sup>5</sup> The "American gentleman" who reported Dr. Franklin as seriously ill was, however, mistaken as to the result, for Franklin survived this attack eight years.

<sup>6</sup> The preliminary articles of a treaty of peace were signed at Paris on November 30th, about seven weeks after the date of Priestley's letter.

<sup>1</sup> This seeming conversion of water into air, which was due to the porosity of the earthen retorts, occupied much of Priestley's time during the succeeding months. (See Letter No. 26, note 2.) In justice to Priestley it should be borne in mind that in corresponding with his friend he gives, impulsively, almost his first impressions before he had time for reflections and corroborative experiments, which eventually led him to very different conclusions. Moreover, his brother philosophers did not regard his deductions as improbable. He wrote briefly of this experiment on the same day to James Watt (see next letter).

strong heat such *volatile substances* as are held in firm combination with others, so as, *in that state*, to bear the heat.

I had also a general idea that if the parts of any bodies be rarefied beyond the sphere of *attraction* they will be in a sphere of repulsion to each other.

Knowing your readiness to promote all philosophical investigations, I make no scruple to inform you that a fresh supply of such small retorts as the last you favored me with will be very acceptable. I must inform you, however, that they often crack after they have been exposed to a strong heat (about 140°) about an hour, but some of them are perfect; the mass will seldom serve twice.

With my best respects to Mrs. Wedgwood I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

P. S. I wish the retorts may be directed to myself and not to Mr. Russell.<sup>2</sup>

MR. J. WEDGWOOD, Hettruria, near Newcastle-under-Line.<sup>3</sup>

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No. 15.

PRIESTLEY TO JAMES WATT.

FAIRHILL, BIRMINGHAM, 8th Dec. 1782.

DEAR SIR: I have the pleasure to inform you that I readily convert water into a permanent air by first combining it with quicklime and then exposing it to a red heat. This, I believe, agrees with your idea on the subject. I have not though, much merit, as I had only random expectations from exposing volatile substances in general to a red heat, when combined with other substances, in imitation of the method of converting the acids into air, when combined with the calces of metals or

<sup>2</sup> Compare these directions with those in Letter No. 7.

<sup>3</sup> The endorsement on the folded letter is in the handwriting of Mr. Chisholm.

with alkaline bodies. When I have the pleasure of seeing you, I will inform you what kind of air I get, and what quantity, &c.<sup>1</sup>

Yours sincerely,  
J. PRIESTLEY.

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No. 16.

PRIESTLEY TO JAMES WATT.

FAIRHILL, 26th Dec. 1782.

DEAR SIR: I have the pleasure to inform you that I now convert water into air without combining it with lime or anything else, with less than a boiling heat, in the greatest quantity and with the least possible trouble and expense. The air

<sup>1</sup> Two days after the date of this letter, which was perhaps the day of its receipt, Watt wrote to Matthew Boulton as follows:—

December 10th, 1782. "You may remember that I have often said that if water could be heated red hot or something more, it would probably be converted into some kind of air, because steam would in that case have lost all its latent heat and that it would have been turned solely into sensible heat, and probably a total change of the nature of the fluid would ensue. Dr. Priestley has proved this by experiment." Watt then describes the experiment much as in this letter, and adds: "The Doctor does me justice as to the theory." (Muirhead's *Mechanical Inventions of Watt*, II., 167.)

Watt wrote also to Wedgwood in the same strain, and received a reply of the same date as the above: "I thank you," says Wedgwood, "for the communication of Dr. Priestley's wonderful discovery of the conversion of water into air *weight for weight*. The Doctor had obliged me with a short account of the discovery but had omitted this last circumstance." (Muirhead's *Mech. Inv. of Watt*, II., 169.)

On December 13th, Watt wrote to Mr. De Luc, informing him of "Dr. Priestley's most surprising discovery," and, after describing the experiment, remarks: "If this process contains no deception, here is an effectual account of many phenomena, and one element dismissed from the list."

On this very same day Watt also wrote to Dr. Joseph Black a long letter in which he again describes Priestley's experiment. (Muirhead's *Corresp. Watt*, pp. 4 to 5.)

is of the purity of that of the atmosphere, and, I think, without any admixture of fixed air.

The method will surprize you more than the effect, but that I may give you the pleasure of speculating on the subject, I shall defer the communication of the hocus-pocus of it, till you give me the pleasure of your company at Fairhill.

I have other curious things to show you.

Yours sincerely,

J. PRIESTLEY.

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No. 17.

PRIESTLEY TO SIR JOSEPH BANKS.

BIRMINGHAM, 28 Dec. 1782.

DEAR SIR: I think myself much honored by your sending me the *Derbyshire mineral*,<sup>1</sup> and shall endeavor, in due time, to give you the best account that I can of it. At present I have made only one experiment upon it, but this seems to afford sufficient data for explaining the phenomenon you mention.

It yields, I find, a considerable quantity of very pure or dephlogisticated air by heat. Supposing, therefore, that the air incorporates with it, and thereby loses its fluidity, heat will be generated, as when water incorporates with lime, and the pure air, which that heat expels from it, will contribute to promote the escape of its phlogiston, and so produce a proper *ascension*,<sup>2</sup> as is the case with substances that contain nitre, or anything else that yields pure air with heat. I should think it is very possible to make artificial mixtures of this kind, that should have the same property in any required degree, and it is very easy to conceive that a most dangerous use might be made of them. But whatever is capable of doing mischief, is likewise of doing good.

<sup>1</sup> This mineral, judging by the results of the experiments made with it and here reported, must have been pyrolusite.

<sup>2</sup> Philosophers, to explain the increase in weight of metals on the escape of phlogiston, had endowed the latter imaginary body with the principle of *levity*, as opposed to gravity; to this Priestley apparently refers.

I should have answered your obliging letter sooner, but that I have been much intent on the prosecution of a singular kind of experiment, which seems to show that *water* is convertible into *permanent air* even without combination with any other substance, and with a very moderate heat.

Endeavoring to distill water in an earthen retort, very little of it comes over in the form of *steam*, but a most astonishing quantity of *air* is always produced. An ounce of water has just given me *ninety-five ounces* measure of air, and this, the second time, that I have used the same retort for the purpose. The air has no mixture of fixed air in it, and is such that a candle will easily burn in it.

When I incorporate the water with quicklime, and expel it again by heat, I get no water at all, but sometimes the whole weight of permanent air of the quality above mentioned, but with a mixture of fixed air. The most difficult circumstance attending these experiments is that they do not succeed with *glass* retorts.<sup>3</sup> Some other curious facts have occurred in the investigation of this business, which I am far from having completed. You are at liberty, however, to mention what I have observed to whom you please, and I shall be particularly obliged to you if you would mention these things to our common friend, Mr. Kirwan,<sup>4</sup> as it will save me the trouble of writing to him till I have done something farther.

I rejoice that we have so zealous and so able a promoter of philosophical researches at the head of the Royal Society,<sup>5</sup> and am,

Dear Sir, your obliged humble servant,

J. PRIESTLEY.

TO SIR JOSEPH BANKS, Bart., Soho Square, London.

<sup>3</sup> At this distance in time, it seems truly astonishing that the fact that Priestley did not succeed with his conversion of water into air when operating in glass vessels, was not at once perceived to be the key to the problem. He repeats this statement in the letter to Wedgwood written a few days later. Compare Letter No. 5, note 1.

<sup>4</sup> See Letter No. 10.

<sup>5</sup> In this and subsequent complimentary phrases used in addressing Sir Joseph Banks, we see something of the courtier's policy.



## No. 18.

PRIESTLEY TO WEDGWOOD.

BIRM. 8th Jan., 1783.

DEAR SIR: Presuming that it will give you some satisfaction, I shall give you the heads of something that I have done farther in the business of converting water into air. I thought I had told you that I get sometimes the full weight of the water in the air, or 800 times the bulk, allowing for the fixed air that I get along with the rest.

It is not necessary to combine the water with lime, gypsum, or even *clay*. Clay never does very well; and what will surprise you more, it is sufficient to put water only into one of your earthen retorts.<sup>1</sup> It soaks into the pores, and is, I suppose, so entangled, though not perhaps *combined* with it, that when I attempt to distil it, and manage the fire carefully, no part of it comes over in the form of steam; but I get a great quantity of air, generally 100 ounce measures from an ounce of water. I am now (for I write in my laboratory) using the same retort the *fifth* time, with the same success; and which proves that it is the *water*, and not the *earth* of the retort, that furnishes the air. I find that when I had not half an ounce weight of air from this retort, it did not weigh a grain less than it did before.

It is remarkable that this experiment does not succeed in a glass retort; the water, though combined with lime, comes over in steam. In a gun-barrel the result is peculiar, too long to explain in a letter.<sup>2</sup>

Mr. Watt tells me you were so obliging as to favor him with an instrument to *levigate* substances and reduce them to an impalpable powder. As I have had abundant experience

<sup>1</sup> Priestley now finds that it is not necessary to combine the water with lime or clay, and that Wedgwood's (porous) retorts alone have the marvellous power of transmuting water into air. (See Letter No. 26, note 2.)

<sup>2</sup> In a gun-barrel the oxidation of the iron and production of hydrogen were the results "too long to explain in a letter" in the prevailing terminology.

of your former readiness to serve me, I shall only say that such an instrument would often be of great use to me.

With my best respects to Mrs. Wedgwood, I am, with great gratitude and esteem, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

MR. J. WEDGWOOD, near Hetruria, Newcastle-under-Line.

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No. 19.

PRIESTLEY TO WEDGWOOD.

BIRM., 16 Jan., 1783.<sup>1</sup>

DEAR SIR: I thank you for the *three retorts* you have been so good as to send me. I have tried *one* of them, and the part that was exposed to the greatest heat (which I found was 143 of your excellent scale) was melted into one mass, while pieces of the former retorts (No. 5) stood very well. I therefore think the latter to be made of the better materials for my use; but I shall [test] the other two in *less heat*, which, indeed, I generally use, viz., about 130. I frequently coat these retorts, but I do not find that it makes much difference, for they generally stand very well till they have been exposed to a great heat about an hour or more, and then if they fail (which they sometimes do not), it is by an opening at the juncture of the stem to the bulb; though sometimes I find them cracked at the bottom, where the heat has been the greatest; but this happens in cooling. I believe I have generally used a heat greater than was necessary, and shall avoid it for the future, so that your No. 5, extra carefully made, will do for me exceedingly well.

I hope you have received a letter I wrote to you a few days ago,<sup>2</sup> giving you a farther account of my converting *water into*

<sup>1</sup> In the year 1783 Wedgwood was elected Fellow of the Royal Society. Priestley had been a Fellow since 1766.

<sup>2</sup> See preceding letter dated eight days earlier.

*air.* It would aid me much in the prosecution of this experiment if you could send me a few retorts completely well *glazed on the outside.*<sup>3</sup>

With the greatest gratitude, I am, Dear Sir,  
Yours sincerely,

J. PRIESTLEY.

MR. WEDGWOOD, Hettruria, Newcastle-under-Line.

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No. 20.

PRIESTLEY TO WEDGWOOD.

BIRM. 23 Jan., 1783.

DEAR SIR: I am much obliged to you for all your queries, and shall be happy to give you all the satisfaction in my power. I have a tolerably good habit of circumspection with respect to *facts*; but as to conclusions from them, I am not apt to be very confident. [Qu. What becomes of 7-8 of the water not converted into air?<sup>1</sup>]

1. Part of the water always gets through the retorts, and is seen rising from it in vapour, though they are absolutely impervious to air.

[Qu. If water passes through the retort outwards, may not air pass inwards?<sup>2</sup>]

2. As there is a considerable resistance to the escape of the air before it can be collected in my recipients, it would certainly make its escape through the pores of the retort, if it could, and could never *enter* that way. Besides, why does the process stop, if air could enter by the retort, and get into the

<sup>3</sup> This request of Dr. Priestley for retorts well glazed shows he begins to suspect that the seeming conversion of water into air is influenced by the porosity of his earthenware vessels.

<sup>1</sup> and <sup>2</sup> The two queries, being those propounded to Priestley by the sagacious Wedgwood, were written in this letter as an interlineation after its receipt by Mr. Chisholm, the private secretary of the latter. For evidence of this consult foot-note on page 93 of George Wilson's *Life of Cavendish*.

recipient?—I have frequently tested the *empty retorts*, and the air they give is a mere trifle.

3. Some have said that the air I get is that which is attracted by the inside of the retort, as it cools, and is condensed in its pores. But after a process I have put the mouth of the retort into a basin of water, while it was all red hot, on the fire, and letting it cool in that situation have plunged it in water, and filled it, without even giving its pores an opportunity of getting any air, and yet it has always, after that, given air as usual.

4. The retorts certainly gain nothing in the fire.

5. I find great differences in the retorts with respect to their property of giving air from the water put into them. The *three* last give very little, owing perhaps to the texture being too compact. I could wish to have one, if possible, of a more porous texture than No. 5, and thicker, to prevent the air, in so spongy a substance, getting through.—I could also wish to have one or two of a texture the most nearly approaching to *porcelaine*, but rough in the inside, that there then may be no pores for the water to get into.

As so much depends upon the *materials* of which the retorts are made, would you be so good as favour me with an account of the composition of No. 5?<sup>3</sup>

I shall thank you for a few more *thermometer pieces*,<sup>4</sup> along

<sup>3</sup> This interesting letter shows that Wedgwood had begun to suspect the cause of the fallacious results of Priestley, and had written a series of questions calculated to bring out the truth. Priestley's request for two kinds of retorts, one "more porous than No. 5," and one of a "texture the most nearly approaching to *porcelaine*," shows he too appreciated the necessity of making the experiment described in such manner as to preclude the entrance of air. In the next letter, written in March, Priestley admits obtaining very different results with retorts "of the *porcelain texture*."

Priestley's admission in the opening sentence that he observed phenomena more skilfully than he draws conclusions is candid, and seems to be confirmed by the disclosures in these letters.

<sup>4</sup> "Thermometer pieces" refer to the cylinders of baked clay used in Wedgwood's Pyrometer, by the expansion of which heat was measured.

with these retorts. I have had ample experience of your goodness, and therefore make no apology for so many wants.

I have heard nothing of late from Paris, and am much rejoiced at the intelligence you send me; a few days must ascertain the truth.

I am, dear Sir,

Yours sincerely,

J. PRIESTLEY.

MR. WEDGWOOD, Hettruria, Newcastle-under-Line.

No. 21.

PRIESTLEY TO SIR JOSEPH BANKS.

BIRMINGHAM, 6 Feb. 1783.

DEAR SIR: I take the liberty to recommend to your notice Dr. Moyes,<sup>1</sup> who is at the same time an excellent lecturer in philosophy, and himself a phenomenon in philosophy, being quite blind, and yet superior to most who see. He is a man of most amiable disposition, and tho' he cannot himself make many experiments, he gets them made by an assistant, so that none of his hearers ever complain on that account. You will have no reason to regret any services you can render him, and you will find him very grateful.

I am busy in pursuing those experiments from which all my friends, except Mr. Kirwan, conclude that there is a conversion of water into air.<sup>2</sup> I hope to have completed them by the time that I usually wait upon my friends in London, when I shall have the pleasure of submitting them to your consideration.

With much respect, I am, Dear Sir,

Your obliged humble servant,

J. PRIESTLEY.

<sup>1</sup> Dr. Henry Moyes, a Scotch chemist, whose affliction is here named. See "The Lunar Society," in APPENDIX.

<sup>2</sup> James Watt, under date February 3d, 1783, in a letter to Dr. Black, quotes Priestley's experiments, and raises no doubt as to the accuracy of his conclusions. (Muirhead's Watt Corresp., p. 13.) And in writing to Mr. Gilbert Hamilton on the 18th February, Watt again quotes Priestley.

## No. 22.

PRIESTLEY TO WEDGWOOD.

BIRM. 7 Mar., 1783.

DEAR SIR: Your retorts will be very acceptable; and I shall trouble you also for a few more of the *porcelain texture*, as I find a very remarkable difference in the results of some experiments made with them. In these retorts I have never failed to convert *whiting*, which is a pure calcareous earth, into a *flinty substance*, that will neither imbibe water, nor be affected by any acid; or at least very little.<sup>1</sup> When I apply the same heat to the same whiting in the other retorts, I only calcine it, after which it will imbibe water, and become whiting again, and this as often as I please.

I have just ascertained by direct experiment what Mr. Kirwan inferred from former ones, viz., that *fixed air* is a compound of dephlogisticated air and phlogiston or inflammable air. I mix *red precipitate*, which gives only the purest dephlogisticated air, and *iron filings*, which gives only inflammable air, and the residue is a great quantity of the purest fixed air, almost wholly absorbed by water; whereas neither of the kinds of air of which it is composed are absorbed by water at all, except in the smallest quantity.<sup>2</sup>

I have nearly finished my present experiments on *water*, and shall soon draw up an account of them for the Royal Society.<sup>3</sup>

<sup>1</sup> Perhaps the whiting calcined strongly in the porcelain-like retorts formed quicklime which united with the silica of the retorts.

<sup>2</sup> Impurity of materials will account for these extraordinary results.

<sup>3</sup> See Letter No. 26, note 2. This work of Priestley is closely connected with the history of the discovery of the composition of water, for which there are three claimants, Cavendish, Watt, and Lavoisier. Priestley was at this time in constant communication with Watt, who was stimulated to experiment on the question by the desire of testing the work of Priestley. For the claims of Watt to the discovery of the composition of water, see Muirhead's *Life of James Watt*, London, 1858, chapter xxi.; also Muirhead's *Correspondence of the late James Watt on his Discovery of the Theory of the Composition of Water*, with a Letter from his Son, London,

With my best respects to Mrs. Wedgwood, I am, Dear Sir,  
Yours sincerely,

J. PRIESTLEY.

P. S.—I beg my respects to Mr. Chelsam,<sup>4</sup> and wish you would mention to him the facts above recited.

JOSIAH WEDGWOOD, Esq., Hettruria, Newcastle-under-Line.

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No. 23.

PRIESTLEY TO JAMES WATT.

March, 1783.

Dr. Priestley has called to inform Mr. Watt that by an improvement in his process he now gets readily 500 ounce measures of air, quite as good as that of the atmosphere, from an ounce of water. He also collects the water that escapes through the pores of the retort, and finds that the weight of this and of the air together, are very nearly the weight of the original water. The water so collected serves for making fresh air as well as fresh water.<sup>1</sup>

1846, 8vo. For the claims of Cavendish, see Wilson's *Life of Cavendish*, London 1851, pp. 265 to 445. For a critical summary of the relative value of the claims of Cavendish, Watt, and Lavoisier see Kopp's *Beiträge zur Geschichte der Chemie*, III. Stück, *Die Entdeckung der zusammensetzung des Wassers*, Braunschweig, 1875.

<sup>4</sup> Of "Mr. Chelsam," mentioned in this and the succeeding letter, I can find no account, and conjecture that the gentleman referred to by Priestley may have been Mr. Alexander Chisholm, who was Wedgwood's private secretary and chemical assistant from the Spring of 1781. Chisholm established a chemical laboratory in Wedgwood's works at Etruria, and this was a rendezvous for the chemical philosophers when visiting the hospitable potter. Chisholm served Wedgwood most ably and faithfully until the death of the former. For an estimate of Chisholm's character see Meteyard's *Life of Wedgwood*, II., 466.

<sup>1</sup> This was a note left by Dr. Priestley at Watt's residence.

## No. 24.

PRIESTLEY TO WEDGWOOD.

BIRMINGHAM, 23 March, 1783.

DEAR SIR: I was much concerned at the Newspaper account of the fire in Greek street, till I was relieved by a truer account from Mr. Boulton. Yours makes me still more easy. It must, however, have disturbed and deranged you much.

I have lately made such experiments relating to the conversion of water into air as must, I think, satisfy even Mr. Kirwan.<sup>1</sup>

By the electric explosion I decomposed dephlogisticated and inflammable air, and I find the weight of the latter in the *water* I get from it.<sup>2</sup>

Finding that part of the water escaped through the pores of the retort in every stage of the process, I performed it in one of the *earthen tubes*, enclosed in an *iron vessel*, so that I could collect all the water that did not make air. In this water and the air together, I find the weight of all the water I make use

<sup>1</sup> Kirwan, see Letter No. 10, note 4.

<sup>2</sup> The formation of water by the combustion of hydrogen was apparently first observed by Macquer in 1776-77, and is described under the article *Inflammable Gas* in his *Dictionnaire de chymie*, vol. ii., p. 314 (Neuchâtel, 1789). He also mentions the combustion of inflammable gas and dephlogisticated air (oxygen).

Priestley seems to have been the first to explode this mixture in closed *glass* vessels. Waltire, a friend and correspondent of Priestley, originated the attempt to *weigh* the products of the combustion. (Priestley's *Exp. & Obs.*, etc., Birmingham, 1781, ii., p. 395.)

Dr. Wilson (*Life of Cavendish*, p. 94) remarks on this sentence: "By the electric explosion, . . . water I get from it," that the wording is ambiguous and might seem to imply that only the weight of the inflammable air burned was found in the water produced by its combustion. "There can be no doubt, however, that Priestley signified that the weight of both the gases concerned in the combustion, was equalled by that of the water they yielded. This at least is the proposition which he undertakes to prove in his paper of 1783 (*Phil. Trans.* 1783, p. 427), and there also he informs us that his experiment was a repetition of one previously tried by Cavendish."



of, and that the water thus collected has undergone no change, is evident from its serving to make more air, just as well as fresh water.

As I shall apply this process of enclosing earthen tubes within iron ones to many purposes, I shall be much obliged to you for a number of them, of the composition of No. 5; and rather thicker in substance than the former ones. I shall also be glad of a few *retorts*, No. 10, such as that which I showed you melted. Another of those, without any coating, bore my common white heat two processes, the last time five or six hours, and was perfectly sound when cool. It grieved me to break it; but I was obliged to do it, as the materials had formed a hard stone in the inside.

I observe that though the retorts often break about the *neck*, it is not at the *junction*; but I believe is occasioned by the difference of the heat to which the bulb and the neck are exposed, and for this there cannot be any remedy.

I am pursuing other experiments with considerable success, and am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

P. S.—This day I complete my half century.<sup>3</sup> I beg my best respects to Mrs. Wedgwood and also to Mr. Chelsum; let him know the experiments mentioned in this.

I shall be obliged to you for a lb. or two of your *ground flint*. Putting a quantity of this, mixed with clay, into the retorts, I get twice as much air from water put into them.

<sup>3</sup> *Date of Priestley's Birth*.—Usually given as March 13th *old style*; so in his Autobiography. The new style was not adopted in Great Britain until 1751; in 1752 eleven days were left out of the calendar. Chalmer's General Biographical Dictionary gives the date of Priestley's birth as March 18; Allen's American Biographical and Historical Dictionary (Boston), and Thomson's History of the Royal Society (London) as March 24; Corry in his Life of Priestley gives March 24 (Birmingham, 1804); Hoefer in his Histoire de la chimie, March 30th, probably following Dumas' Philosophie de chimie. Some of the above discrepancies may be accounted for by confusion of old and new styles.

One ounce of water, in this way, never fails to give me 200 ounce measures of air, as often as I please, in the same retort. I long to show you this experiment.<sup>4</sup>

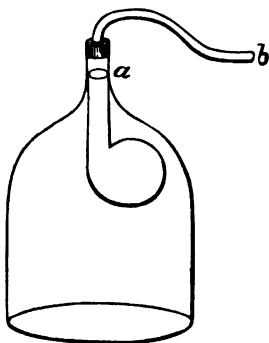
JOSIAH WEDGWOOD, Esq.,<sup>5</sup> Etruria, Newcastle-under-Line, Staffordshire.

No. 25.

PRIESTLEY TO JAMES WATT.

LONDON, 29th April, 1783.

DEAR SIR: Behold, with surprise and indignation, the figure of an apparatus that has utterly ruined your beautiful



hypothesis, and has rendered some weeks of my labour in working, thinking and writing, almost useless.<sup>1</sup>

<sup>4</sup> This fallacious experiment, confided to his intimate friend immediately after its performance, Priestley revoked in his final publication. See Letter No. 26, note 2.

<sup>5</sup> On March 13, 1783, Wedgwood read a paper before the Royal Society entitled "Some Experiments upon the *Ochra friabilis nigro fusca* of Da Costa, and called by the miners of Derbyshire, Black Wadd." (Phil. Trans., 1783, 284.)

<sup>1</sup> Priestley had been almost constantly occupied for five months in his experiments on the transformation of water into air (compare Letter No. 14, dated Dec. 8, 1782), but now admits to his brother philosopher that the supposed phenomena were merely due to the porosity of the earthen retorts.

In order to ascertain the effect of heating the moist clay in an earthen retort, on the *external air*, I put the retort within a glass receiver standing in a basin of water, and with good luting made the junction air-tight at *a*. Then throwing the heat of Mr. Parker's excellent lens upon the bulb within the receiver, air was collected very copiously at *b*, and the water ascended within the receiver. This looked like a phlogistication of the internal air; but the process went on till more than three-quarters of the internal air disappeared, and I believe it would all have gone farther if the water had not almost covered the bulb of the retort. The process then stopping, I found I had got about as much air as was missing in the receiver. It was, however, a little better than the air of the atmosphere, and the remainder of the air within the receiver was a little worse, but only a mere trifle. It is therefore a new hydraulic engine, but on what principle it acts I know not. It is more within your province than mine. You must convene the club<sup>2</sup> and give me your joint opinion.

Before this experiment I had fully satisfied Mr. Kirwan<sup>3</sup> of the reality of the conversion. He and many others saw the simple experiment (with the retort in the fire) with astonishment.

With my best respects to Mrs. Watt, and also all our club, I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.<sup>4</sup>

P. S. I have just received yours.

<sup>2</sup> The Lunar Society. See APPENDIX.

<sup>3</sup> See Letter No. 10, note 4.

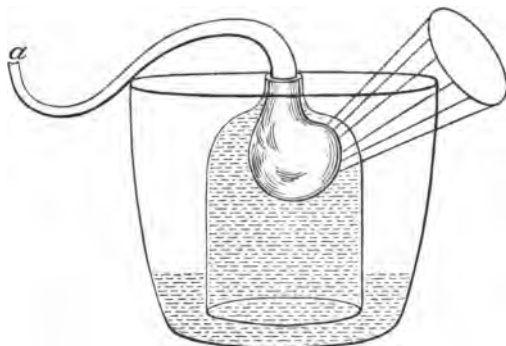
<sup>4</sup> Watt replied to this letter at once, writing (May 2d, 1783) thus: "I deny that your experiment ruins my hypothesis," and suggests various explanations and modifications. (For full letter see Muirhead's *Corr. Watt*, p. 26.)

No. 26.

PRIESTLEY TO WEDGWOOD.

LONDON, 6 May, 1783.

DEAR SIR: Having just finished some experiments of a pretty extraordinary nature, I make haste to give you some account of them.<sup>1</sup>



By means of Mr. Parker's lens, I heat an earthen retort, filled with moistened clay. When the neck of it is well luted to the upper orifice of a glass receiver, which is placed in a bason of water, and a glass tube communicates with the inside of the retort. In consequence of this the water from the clay comes into the receiver, while the air in the receiver passes through the retort, and is delivered at *a*; the water in the bason rising within the receiver and covering the retort. If it be inflammable air, it comes through inflammable, if nitrous, nitrous. This must be by the air losing its *aerial form* while it combines with the earth of the retort, and recovers its *aerial form* in the inside of it. If the retort was not perfectly air-tight, the water could not rise within the receiver. Spirit of wine comes in through the receiver, just as the water does.

This renders *one* of my processes of the conversion of water into air fallacious, after I had fully satisfied even Mr. Kirwan

<sup>1</sup> Priestley repeats here the figure (rudely drawn) occurring in the letter to Watt.

of the reality of that conversion. Another experiment is not so easily explained.

Making water to boil in a glass retort, I make the steam go through a red-hot tobacco pipe, when I always get much air mixed with the steam. In the same manner, spirit of wine makes inflammable air, and spirit of nitre the purest dephlogisticated air. But if the tobacco pipe be not hot I get only *vapour*, and no *air*, from any of the liquors.

I cannot in a letter enlarge on all the particulars of these experiments, which excite a good deal of attention here. I shall lay them before the Royal Society,<sup>2</sup> and pursue them at my leisure as soon as I get home.

<sup>2</sup> Priestley's paper was presented to the Royal Society June 26, 1783, and is entitled: "Experiments relating to Phlogiston and the seeming Conversion of Water into Air." (Phil. Trans., 1783, 399.) As we believe it is of interest to compare the language of his completed paper with that of these hasty letters, we give long quotations from it. In the first section, "relating to Phlogiston," he narrates his experiments in reducing minium and other oxides by various gases, "two kinds of inflammable air," "alkaline air," etc. He also thanks Mr. Parker for his excellent burning lens, twelve inches in diameter. In the second section Priestley writes: "Accordingly, I took a quantity of well-calcined lime, and mixing with it a little water, out of which all air had been carefully boiled, I exposed it gradually to a strong heat in an earthen retort, such as I had usually been supplied with by Mr. Wedgwood (who is as much distinguished by his love and generous encouragement of science, as he is by his improvements in his own curious art), not imagining that it could make any difference whether the lime so prepared should receive its heat in an earthen retort or in a vessel of iron or glass. Proceeding, however, in this manner, I found that nothing came over in the form of steam, but that there was a great quantity of air, several hundred times more than the bulk of the water." Priestley supposed that the water was transformed into air, and says: "But I, as well as all my friends, was a long time utterly disconcerted upon finding that when I put the whiting and water into a coated glass retort, the water came over in the form of steam, and little or no air was produced. The result was the same when I made the process in a gun-barrel, in a porcelain retort, or even in an earthen retort glazed in the inside."

Priestley at length discovers that the whiting is quite superfluous, gives details of his numerous trials, and says: "Still hearing of many objections to the conversion of water into air, I now gave particular

I thank you for your excellent *address to your neighbours*,<sup>3</sup> and am much disappointed in not meeting with you here.

With greatest gratitude and respect,

I am, Dear Sir, yours sincerely,

J. PRIESTLEY.

JOSIAH WEDGWOOD, Etruria, Newcastle-under-Line, Staffordshire.

No. 27.

PRIESTLEY TO SIR JOSEPH BANKS.

BIRMINGHAM, 23 June, 1783.

DEAR SIR: I certainly meant to submit my paper to the Royal Society, as it contains a series of remarkably new facts, completely ascertained, whatever *deductions* (about which I

attention to an experiment of Mr. Cavendish's concerning the re-conversion of air into water, by decomposing it in conjunction with inflammable air."

He used inflammable air made from charcoal and "found a manifest deposition of water," tried to compare its weight with that of the air by weighing the moisture collected by a tared filter-paper, and as a result had a "strong presumption that the air was re-converted into water, and therefore that the origin of it had been water."

He then describes the experiment given in Letter No. 18, and concludes that "this experiment made it probable that the air on the outside of the receiver had actually passed through it." Finally, he comes to the conclusion that the "clay of the earthen retort, being thus heated, destroys for a time the aerial form of whatever air is exposed to the outside of it; which aerial form it recovers after it has been transmitted in combination from one part of the clay to another, till it has reached the inside of the retort, while the water is drawn through it in the contrary direction." Priestley's paper is dated Birmingham, April 21, 1783.

<sup>3</sup> In the year 1783 the prevailing disorder in manufacturing districts extended to the Potteries, and riots ensued which were speedily quelled by the militia and the execution of one of the aggressors. As soon as tranquillity was restored to the district, Mr. Wedgwood wrote and published a small pamphlet intended to enlighten the younger employes as to the folly of such outbreaks to redress social wrongs. This was entitled: "An Address to the Young Inhabitants of the Pottery." Later in the same year Wedgwood published another pamphlet.

am not solicitous) be drawn from them. As I have opportunity, I shall prosecute the experiments farther, and if anything materially new should occur to me, I shall send you a supplemental paper on the subject.

Mr. Watt wishes to withdraw his paper,<sup>1</sup> but he is now engaged in a course of experiments, in which he thinks he shall prove the actual conversion of water into air, tho' mine certainly prove no such thing.

When I see the young man who made the air-gun, I shall mention to him your desire of having it. It is very generous in you, and worthy of a President of the Royal Society, to interest yourself, as you do, in all scientific pursuits, however foreign to your own. It is a wide and noble field that

<sup>1</sup> This letter of James Watt is the famous one on which his friends base their claim that he should be acknowledged as the discoverer of the composition of water. The original letter, which seems to have been written April 21st, 1783, was withdrawn a few days later, "on account," says Watt, in a letter to Dr. Black dated June 23d, "of an ugly experiment the said Dr. Priestley tried at my desire, and which renders the theory useless in so far as relates to the change of water into air by means of porous earthen vessels." Watt revised this letter, and, as printed in the Philosophical Transactions, it contains these passages. After describing Priestley's experiment of exploding with the electric spark a mixture of pure dry dephlogisticated air and of pure dry inflammable air, and collecting moisture nearly equal in weight to the air employed, Watt writes: "Let us now consider what obviously happens in the case of the deflagration of the inflammable and dephlogisticated air. These two kinds of air unite with violence; they become red hot, and upon cooling totally disappear. When the vessel is cooled a quantity of water is found in it equal to the weight of the air employed. The water is then the only remaining product of the process, and *water*, *light*, and *heat* are all the products. Are we not then authorized to conclude that water is composed of dephlogisticated air and phlogiston deprived of part of their latent or elementary heat; that dephlogisticated or pure air is composed of water deprived of its phlogiston and united to elementary heat and light?"

Watt, it is scarcely necessary to remark, uses phlogiston as a synonym of inflammable air. This letter was shown to several members of the Royal Society, and delivered to Sir Joseph Banks for public reading, but, unfortunately for Watt's reputation, this was not done. It was finally read April 22d, 1784, a whole year subsequent to its date.

we are employed in, and the truly liberal will rejoice in, and promote, each other's success—I thank you for your intelligence from Paris. For my own part, I wish to see either Crawford's<sup>2</sup> or M. Lavoisier's *facts* unexceptionally ascertained by competent witnesses.

I have just heard from Mr. Kirwan, and shall write to him as soon as I have anything worth communicating. In the meantime I wish you would inform him that I have in a glazed earthenware retort got 787 ounce measures of dephlogisticated air from *two ounces* of purified nitre.<sup>3</sup>

With the greatest respect,

I am, Dear Sir, yours sincerely,

J. PRIESTLEY.

JOSEPH BANKS, Bart., Soho Square, London.

# No. 28.

## PRIESTLEY TO WEDGWOOD.

BIRMINGHAM, July 24, 1783.

DEAR SIR: I am much obliged to you for the stock of *Longnecks* you have been so good as to send me. I must inform you, however, that the necks are too short for the principal uses of them, and that they ought to be as long as those of the retorts; that the mouths may be handled while the bellies are in a white heat.

I have lately had a proof of the excellent temper of No. 9. In this retort I got, from two ounces of purified nitre, 812 ounce measures of dephlogisticated air, and afterwards

<sup>2</sup> Adair Crawford, M.D. (1749–1795), Professor of Chemistry at the Military Academy of Woolwich. Dr. Crawford made the first determinations of the specific heat of gases, and proposed a much discussed theory of heat.

<sup>3</sup> These same data are mentioned in a letter written by Watt to De Luc on the 26th June, 1783. For an analysis of the share borne by Watt and Priestley, in connection with the water controversy, see Wilson's *Life of Cavendish*, pp. 295, 296.



exposed it to the fire a second time, with oil of vitriol put to the residuum, and to appearance it is as sound as ever. Such retorts as these will be considered as invaluable by all chemists when their properties are known. Never before could it have been known that anything like this quantity of air could be got from nitre. Mr. Kirwan owns that he does not know what to make of the experiment, as it does not agree with his idea of the constituent parts of nitre nor with that of Mr. Bergman.<sup>1</sup> It seems also to puzzle Mr. Watt, as hardly any nitrous acid (though there is a little) left in the residuum. What then can become of it, if it has not been changed into air, which is my idea. He, however, still thinks that it is water that furnishes the air.<sup>2</sup> I carry him the residuum, and they cannot be in better hands. I hope we shall make out something among us all. But without your retorts, or long-necks, we can do nothing.

I have got a good deal of light into the *black matter* that is sometimes found in firing inflammable in dephlogisticated air. It is altogether from the *mercury*, but the circumstances of its production requires to be investigated further.

What the pipe maker calls the *dressing* of his wares, and which gives them the last polish, is a mixture of equal parts of *white wax* and soap boiled to the consistence of paste with *water*. When the pipes are completely burnt he puts a little of this paste in a piece of flannel, and only wipes them with it, and

<sup>1</sup> Sir Torbern Bergman (1735–1784), the distinguished Professor of Chemistry at the University of Upsala. His complete works were translated by Dr. Edmund Cullen, and entitled “Physical and Chemical Essays;” London, 1784–’91, 3 vols., 8vo.

<sup>2</sup> Watt’s idea was that the air (oxygen) was derived from the water, supposed to be a constituent of the saltpetre. He wrote thus: “Nitre, besides its water of crystallization, contains a quantity of water as one of its elementary parts, which water adheres to the other parts of the nitre with a force sufficient for it to sustain a red heat. When the nitre is melted or made red-hot, the acid acts upon the water and dephlogisticates it; and the fire supplies the humor with the due quantity of heat to constitute it air, under which form it immediately issues.” (Phil. Trans. 1784, p. 336.)

with another piece of flannel rubs them dry again. He made no secret of it.<sup>3</sup>

In three weeks, or a month, I expect a visit from Mr Bewley,<sup>4</sup> to spend about a week with me. I should be very happy to see you at the same time. We shall have a meeting of the Lunar Society extraordinary on the occasion.

With the greatest gratitude and esteem,

I am, Dear Sir, yours sincerely,

J. PRIESTLEY.

P. S. My wife joins me in respectful compliments to yourself and family.

JOSIAH WEDGWOOD, Esq., Etruria, near Newcastle-under-Line.<sup>5</sup>

<sup>3</sup> This seems to be a reply to a query by Wedgwood.

<sup>4</sup> William Bewley, an apothecary and surgeon of Great Massingham, Norfolk. Bewley's review (in 1767) of Priestley's *History of Electricity* was the origin of a correspondence which, says Priestley, "was the source of much satisfaction to me as long as he lived. I instantly communicated to him an account of every new experiment that I made, and in return was favored with his remarks upon them. All that he published of his own were articles in the Appendices to my volumes on air, all of which are ingenious and valuable. Always publishing in this manner, he used to call himself my *satellite*. There was a vein of pleasant wit and humor in all his correspondence, which added greatly to the value of it. His letters to me would have made several volumes, and mine to him still more. When he found himself dangerously ill, he made a point of paying me a visit before he died; and he made a journey from Norfolk to Birmingham, accompanied by Mrs. Bewley, for that purpose; and after spending about a week with me he went to his friend Dr. Burney, and at his house he died." (Rutt, I., 79.) Bewley died Sept. 5, 1783, a few weeks after the date of this letter; hence the visit alluded to herein is evidently the same with that named in Priestley's *Memoirs* above quoted.

<sup>5</sup> The endorsement on the folded letter is in the handwriting of Mr. Chisholm.

## No. 29.

PRIESTLEY TO WEDGWOOD.

d<sup>d</sup> = dephlogisticated.BIRM. 16th Jan. 1784.<sup>1</sup>

DEAR SIR : As you are pleased to interest yourself so much in the prosecution of my experiments, and I have made some that my friends here think to be of particular consequence, I take an early opportunity of informing you of them. But I want a lens of greater power to pursue them to advantage.

The great problem with us *aerial philosophers* (not navigators) of late, has been to find what becomes of d<sup>d</sup> and inflammable air when they are made to unite, as by explosion, &c. ; some saying that they make *water*, others *fixed air*, &c.<sup>2</sup> The following experiments show that, in different circumstances, they make *both*, and also that d<sup>d</sup> air incorporates with iron in a great proportion.

Throwing the focus of a burning lens upon some shavings of iron, in d<sup>d</sup> air, confined by mercury (both very warm and dry), the air disappeared, no water was formed, but some fixed air ; and the *slag*, to which the iron was reduced, had gained as much weight 'as that of the air that had vanished. In the open air 24 grains of iron gained 5 grains, and the same

<sup>1</sup> This date is as given, but the letter is endorsed by Josiah Wedgwood, *June*, 1784, probably owing to a hasty glance at the indistinctly written name of the month. Beneath the endorsement of Wedgwood, is a pencil memorandum stating : "[This June should be January]. G. W.," written by Dr. George Wilson, when examining this letter. According to the latter three unbiassed parties, including a great grandson of Josiah Wedgwood, all read the word January. Mr. Francis Wedgwood suspects that his grandfather did not always docket his letters when he received them, and urges cogent reasons for this opinion. (Wilson's *Life of Cavendish*, page 95.)

<sup>2</sup> Lavoisier and Cavendish maintained that inflammable air (hydrogen) and dephlogisticated air (oxygen) form water only when combined ; Kirwan, on the other hand, held that the product of the union was fixed air ; Priestley in this letter says that both water and fixed air are formed under different circumstances.

quantity of steel gained  $7\frac{1}{2}$  grains of pure air. After this my lens could not melt it, nor would any acid, except the marine, dissolve it. It is the same thing as the *scales* of iron on a smith's forge.

Throwing the focus of the lens upon iron thus saturated with d<sup>a</sup> air, in inflammable air, confined by mercury (all very dry), the air disappeared and the iron lost as much weight as if reduced to d<sup>a</sup> air would have saturated the inflammable air that had disappeared; and in this case as much *water* was produced as, I imagined, would have been equal to the weight of the air.

Another experiment shows a remarkable difference between the inflammable air from metals and that from *charcoal*. Having mixed a quantity of each of them with half as much d<sup>a</sup> air, I exploded that from iron, and found neither *water* nor *fixed air*; but exploding the mixture that contained the inflammable air from *charcoal*,  $3\frac{1}{2}$  ounce measures of the mixture yielded an evident quantity of *water*, and 4-5 of an ounce measure of pure fixed air.<sup>3</sup>

Resuming my experiments on the seeming conversion of water into air, I find that a vessel of *chalk* answers as well as one of *clay*, and mercury answers as well as water, going thro the retort one way, while the air goes the contrary way, and when, in the same state of heat, an air pump [cannot] force a particle of mercury thro [MS. torn] it comes thro in the form of a *black powder*. Also alkaline air is transmitted as well as air of any other kind.

It will save me some trouble, if you will communicate these facts to Mr. Kirwan.<sup>4</sup> You may also ask him, and Sir Joseph

<sup>3</sup> This paragraph is full of inconsistencies. Priestley had previously affirmed (in print) that he could burn the inflammable air from charcoal (a mixture of carbon monoxide, hydrogen, etc.), along with oxygen into their conjoined weight of water. Here he states in contradiction to that incredible announcement that fixed air, as well as water, results from the combustion. At the same time he makes the extraordinary assertion that inflammable air from metals (hydrogen) unites with oxygen, and yet produced *no* water. Cf. Letter No. 31.

<sup>4</sup> Kirwan, see Letter No. 10, note 4.

Banks,<sup>5</sup> whether they think it worth while to send an account of them to the Royal Society before the summer recess.

I am, with gratitude and respect,

Dear Sir, yours sincerely,

J. PRIESTLEY.

P. S. Knowing your goodness I took the liberty to write to Mr. Cox<sup>6</sup> for some retorts of which I was much in want, and I expect them very soon.<sup>7</sup>

To JOSIAH WEDGWOOD, Esq., Etruria, Staffordshire.

### No. 30.

#### PRIESTLEY TO WEDGWOOD.

BIRM. 23d Jan. 1784.

DEAR SIR: The pipe-maker is not *so much* your rival, but that I am happy to employ you both. Of late, however, tho' I have been very busy, it has not been in a way to require the assistance of either of you; but I shall very soon want a good many of your retorts, &c., and as I have had abundant proof of your readiness to supply me, shall not hesitate to mention the whole extent of my wants as I feel them. At present then (to show you that I am in earnest) I shall be obliged to you for *two dozen of the small-sized retorts*, and of a number higher than 5. For some that I had in the last parcel, Nos. 6 and 8 were excellent. But I wish to have a dozen of these with inclined necks, about *an inch inside*, as they will be better for distilling phosphorus, in the process of which I am endeavoring to make some improvements. As to the *materials*, I am

<sup>5</sup> Sir Joseph Banks, see Introduction.

<sup>6</sup> William Cox, Wedgwood's bookkeeper and manager of the London house. "Painfully reserved, procrastinating, honest, yet dilatory and careless to a fault," his character was pronounced by Wedgwood an "enigma."

<sup>7</sup> On Jan. 15, 1784, the day before this letter was written, Cavendish read a paper to the Royal Society under the title: "Experiments on Air." (Phil. Trans., 1784, 119.)

confident that, with good management, they will do as well as the Hessian. Please also to send *half a dozen long necks*, an inch in the inside, the belly of the long necks no larger than those of the retorts, as they must be coated, and must not be too large for my furnace.

I have had some curious results in my late experiments; but none I believe that will much interest you, tho' I am projecting some that perhaps *may*. In the experiments on *nitre*, I get from it more than half its weight in the purest air,<sup>1</sup> and yet saw reason to conclude, that no part of the *acid* entered into the air. This was in part imbibed by the water in which it was received, and in part was volatilized, all the air smelling strongly of it. This greatly favours Mr. Watt's hypothesis that air<sup>2</sup> is dephlogisticated water. In this business I am little more than the *bellows-blower*.<sup>3</sup>

I have made a curious discovery on the colouring of spirit of nitre by *light* acting on the *vapour* of it. A bottle *completely full* of the colourless acid gets no colour either by light or heat. If it be *in part full*, it gets colour by light but not by heat; and it makes no difference whatever kind of *air* be incumbent upon it, or whether there be a *vacuum* in the upper part of the phial. With a lens I can presently give it an intense orange. This vapour, imbibed by the acid, gives colour to the whole. Any phlogiston substance will give it colour without light; so that light imparts phlogiston.

By exposing bladders full of air, in jars containing other

<sup>1</sup> Pure nitre contains 47.5 per cent. of oxygen, but it cannot all be expelled by heat. Priestley's rough determination gives too large a proportion of "purest air." At a high heat the nitrogen is set free, and perhaps this explains Priestley's vain search for the acid.

<sup>2</sup> Air here evidently means oxygen.

<sup>3</sup> Dr. Wilson makes the most of this modest avowal, and says: "With characteristic frankness, Priestley disavows all but a slender share in leading to the formation of the opinions of Watt concerning water." Watt's view was that water consisted of phlogiston, or inflammable air, and dephlogisticated air (oxygen). By depriving water of the former oxygen was obtained, and by such a loss of the phlogiston of the water hypothetically present in it nitre was supposed to yield oxygen. Priestley published the same views in 1785 (Phil. Trans.).

kinds of air, I find that, tho' they remain sound, the airs in time mix completely;<sup>4</sup> and sometimes decompose each other, which explains the action of air on the blood in the lungs, &c.

I have begun to make some experiments on iron, and have just found one curious fact. Mr. Francis's *cast nails* are with great difficulty soluble in acids. I was near three days in dissolving a  $\frac{1}{4}$  oz. After he has annealed them, by keeping them hot in saw-dust, they dissolve as well as any iron whatever. *Steel*, I find, after Bergman, does not yield more inflammable air than iron; but it contains a good deal of matter not soluble in oil of vitriol, which contains much phlogiston.

I hope to send this by Mr. Coxe; but since I saw him, I have had a bad accident; a phial of hot oil of vitriol having exploded, spoiled my clothes, and burnt my hand; so that I shall not be able to do anything in the laboratory for some days.

With the greatest gratitude and esteem, and hoping to meet you in London, I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

Mrs. P. joins me in compliments to yourself and Mrs. Wedgwood.

P. S. I thank you for excellent *Address to the Potters*,<sup>5</sup> and hope it will be of much use. I am also [glad] to hear that you have so nearly succeeded in the comparison of your *thermometer* with Fahrenheit's.<sup>6</sup>

TO JOSIAH WEDGWOOD, Esq., Etruria, near Newcastle-under-Line.<sup>7</sup>

<sup>4</sup> A very early observation on the osmose of gases. The osmose of liquids had been remarked by Abbé Nollet in 1748.

<sup>5</sup> "An Address to the Workmen in the Pottery on the subject of entering into the service of Foreign Manufacturers." This was intended to arrest the emigration of his workmen to America and to France; from the latter place emissaries and spies had endeavored to seduce the potters of Etruria to desert. (Meteyard, II., 476.) Cf. Letter No. 26, note 3.

<sup>6</sup> See Letter No. 12, note 3.

<sup>7</sup> The endorsement is in the handwriting of Mr. Chisholm. In the interim between the date of this letter and that of the next in this series James Watt published two papers, entitled: "Thoughts on the Constituent Parts of Water and of Dephlogisticated Air;" the first being read April 29, and the second May 6, 1784.

## No. 31.!

PRIESTLEY TO WILKINSON.

BIRM. 16 JUNE, 1784.

DEAR SIR: Though I do not know that such experiments as mine are very interesting to you, yet as I am desirous of giving you any satisfaction that may be in my power, I wish to communicate the result of some that I have lately made, and that my friends think to be of importance. You may get Joseph<sup>1</sup> to transcribe this account for M. Senebier<sup>2</sup> or any philosophical persons that he may meet with.

A very interesting problem with us of late has been to determine what becomes of dephlogisticated and inflammable air when they are made to unite, as by exploding them with the electric spark, &c.; some saying that they make *water*, others fixed air, &c. The following experiments show that in different circumstances they make *both*; and also that dephlogisticated air incorporates with iron in a great proportion.

Throwing the focus of a burning lens upon some small pieces of malleable iron in dephlogisticated air, confined by mercury (both very warm and dry), the air disappeared, no water was formed, but some fixed air, and the slag to which the iron was reduced had gained as much weight as that of the air that had been absorbed. Melting the iron in the open air 24 grains gained five grains, and the same quantity of steel gained  $7\frac{1}{2}$  grains of pure air. After this my lens could not melt it, nor would any acid except the marine dissolve it. It appeared to be the same thing as the *scales of iron* from a smith's forge.

Throwing the focus of the lens upon iron thus saturated with dephlogisticated air, in inflammable air, confined by mercury (all very dry), the air disappeared, and the iron lost as

<sup>1</sup> Priestley's son, then in Paris with Mr. Wilkinson.

<sup>2</sup> Jean Senebier (1742-1809), a Swiss naturalist and man of letters, residing in Geneva. A clergyman, like Priestley, he was devoted to researches in natural philosophy, and had published in 1782 and 1783 two memoirs on the influence of the sunlight in changing fixed air into pure air by the agency of plants.



much weight as, if reduced to dephlogisticated air, would have saturated the inflammable air that had disappeared, and in this case, as much water was produced as I imagined would have been equal to the weight of the air.

Another experiment that I have made shows a remarkable difference between inflammable air from *metals* and that from *charcoal*. Having mixed a quantity of each of them with half as much dephlogisticated air, I exploded that from *iron* by means of the electric spark, and found neither water nor fixed air; but firing the mixture that contained the inflammable air from *charcoal* (which showed no sign of its containing fixed air),  $3\frac{1}{2}$  ounce measures of the mixture yielded an evident quantity of *water*, and likewise almost an ounce measure of pure *fixed air*.<sup>3</sup>

Resuming my experiments on the seeming *conversion of water into air*, I find that a vessel of *chalk* answers as well as one of *clay*, and *mercury*, as well as *water*, passing thro' the retort one way in the form of a *black powder*, while the air passes the contrary way, and when, in the same degree of heat, an air-pump cannot force a particle of mercury thro' it. Also alkaline air is transmitted as well as air of any other kind.

As it will save some expence of postage, I also wish that Joseph would transcribe this account, and send it with my compliments to Sig. Marsiglio Landriani, at Milan.<sup>4</sup>

We are all well except Sally, who has been confined to her

<sup>3</sup> Chemical philosophers of the day generally confounded the different kinds of inflammable air, an oversight which greatly hampered their researches. Here Priestley clearly recognizes the difference between the "inflammable air from metals" (hydrogen), and that "from charcoal" (carbon monoxide), but incorrectly interprets the results of their union with dephlogisticated air (oxygen), by overlooking the production of water in the first case. (Compare Wilson's *Life of Cavendish*, pp. 297-313.)

<sup>4</sup> Marsiglio Landriani, attached to the Court of Albert of Sachsen-Teschen at Vienna, and a correspondent of the French Academy of Sciences, was favorably known as a physicist and chemist. Before visiting England he had published researches on the physics of air and on chemical subjects. He had had correspondence with Priestley as early as 1776, who mentions him several times in his *Experiments and Ob-*

room by a rheumatic fever, and is indeed very far from being recovered. She joins with your sister and all of us in best wishes to you both. Mr. and Mrs. Barbauld<sup>5</sup> are now with us, and are to take William<sup>6</sup> with them, and Harry is expected from school to-morrow or the next day. I shall be glad to hear of you, and hope that Joseph will behave to your satisfaction.

I am, Dear Sir, with gratitude and respect,

Yours affectionately,

J. PRIESTLEY.

A MONSIEUR WILKINSON, a Montcenis, en Bourgogne, France.

Paid to London.

## No. 32.

### PRIESTLEY TO KEIR.

FAIR HILL, Tuesday 18th August, 1784.

DEAR SIR: I send for your general inspection, not for your reading, the first book of my work, and also the introduction.<sup>1</sup> I have to peruse it once more before it goes to the press. The

servations on Different Kinds of Air. The dates of Landriani's birth and death are uncertain; they were unknown to Poggendorff. Landriani seems to have been the first to use the name eudiometer for the well-known instrument (Black's Lectures, Philadelphia, 1806, vol. iii., p. 225), one of which he sent to Priestley, accompanied by a letter dated Nov. 17, 1776. (Priestley's Obs. and Exp. on Air, vol. iii., Appendix 4.) Compare Letter No. 46.

<sup>5</sup> Anna Lætitia (Aiken) Barbauld (1743-1825), the poet and essayist, had long been a friend of Dr. and Mrs. Priestley, their acquaintance beginning in Warrington, where her father was a teacher. Of her Priestley says in his Memoirs: "Mrs. Barbauld has told me that it was the perusal of some verses of mine that first induced her to write anything in verse, so that this country is in some measure indebted to me for one of the best poets it can boast of." And he alludes to her visits to his house elsewhere. (Rutt's Life, I., 54.)

<sup>6</sup> William and Harry, Priestley's younger sons.

<sup>1</sup> This brief and unimportant letter is introduced merely to show the constant friendly intercourse maintained by Priestley with his philosophical neighbors and correspondents. We are unable to say to what volume Priestley here refers.

last article (MS.) contains the result of the experiments you saw going on in my laboratory.

I wish to see you before we begin to print, which may be in a week or ten days.

Yours sincerely,

J. PRIESTLEY.

To JAMES KEIR, Esq., Smethwick.

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No. 33.

PRIESTLEY TO WEDGWOOD.

BIRM. 8th Nov'br, 1784.

DEAR SIR: I know you will not be displeased with my telling you, that I was never more impatient for anything, than I now am to receive the *earthen tubes* you have been so obliging as to promise me, especially when I give you the reasons for it.

Hitherto I have used a *copper tube*, because water did not act upon it. But sending thro' it *spirit of wine* in vapour, it was totally dissolved, and actually fell in pieces in a very short time. I was astonished at the production of inflammable air in the process, which resembled the blowing with a pair of bellows. Four ounces of spirit of wine did the business for this tube which was about  $\frac{1}{4}$  of an inch thick. What was condensed by the warm tub was mere *water*. The inflammable air which had no fixed air in it had come from the copper. The inside was reduced to a black powder.

Iron, I find, gained one-third in weight in this process, and gives one-half more inflammable air than it does when dissolved in acids, the reason of which I believe to be that much of the phlogiston is always retained in the solution of metals in acids. On comparing the experiments, I *now* think that the inflammable air is furnished by the iron, and that there is no decomposition of the water. Mr. Watt thinks so too.<sup>1</sup>

<sup>1</sup> Priestley is still at sea in attempts to explain the phenomena he so industriously and minutely observed. The view that the "inflammable air is furnished by the iron" is in accordance with the doctrine of the phlogistians.

Iron that is thus increased in weight, and has yielded so much air (which, by the way, has not the least *offensive smell* which has been so much complained of in filling balloons) is reduced to its former state by heating in charcoal. In this process, instead of yielding *water*, as we all imagined it would, it yielded a prodigious quantity of *inflammable air*, but of a peculiar kind, for it is about as heavy as common air, owing, as I found, to its containing a great quantity of *fixed air* combined with it, so as not to be separated by lime water, but only by decomposition with pure air, by the electric spark.<sup>2</sup>

Mr. More<sup>3</sup> of the Adelphi<sup>4</sup> was with me when he observed, by his stop watch, that, heating about one foot of my copper tube (not quite  $\frac{1}{4}$  of an inch in diameter) filled with iron shavings I always filled a vessel containing 30 ounce measures of air in 50 seconds. There can be no doubt, therefore, but that this process must be abundantly the best for filling balloons.

With our best respects to all your family, I am,

Dear Sir, Yours sincerely,

J. PRIESTLEY.

To JOSIAH WEDGWOOD, Esq., Etruria, near Newcastle-under-Lime,  
Staffordshire.<sup>5</sup>

<sup>2</sup> This heavy inflammable air was probably chiefly carbon monoxide, and the carbon dioxide which he imagined to be combined with it was produced by the union of the carbon monoxide and the oxygen, when the two were exploded.

<sup>3</sup> Probably Mr. Samuel More (1724–1799), Secretary of the Society of Arts. He was a man of wealth and taste and appears to have dealt in objects of vertu. He obtained samples of minerals for Wedgwood on various occasions; in 1773 he sent him petunse and kaolin from China. See Letter No. 41.

<sup>4</sup> "Adelphi" was the name of the building in which were the London showrooms of Wedgwood and Bentley, opened in 1772.

<sup>5</sup> The endorsement on the folded letter is in the handwriting of Mr. Chisholm.

## No. 34.

## PRIESTLEY TO WEDGWOOD.

May, 1785.

DEAR SIR :<sup>1</sup> About the time that this comes to hand I hope you will receive three copies of my *paper of experiments*<sup>2</sup> printed for the Philosophical Transactions, of which one is for yourself, another for Dr. Darwin, and the third for the gentleman who was so obliging as to join you in contributing to the expence of my experiments, but wished to be unknown.

I am making the most of the fine sunshine we now enjoy ; and have lately discovered some very remarkable new facts, which promise to throw much new light on the doctrine of air, &c. They could not be made but by means of a burning lens.

I have been just trying a new process for procuring the charcoals of the several metals, some of which I shewed you, but it has not yet succeeded ; but I do not despair, and I hope to do this and much more, when I get a *larger lens*. As soon as I can get a tolerable assortment of these new modifications of the metals, I shall send them to you, either in London, or at Etruria.

I wish your business of application to Parliament<sup>3</sup> was in as good a train as my experiments are at present. Your exertion, however, tho' unsuccessful, will do you the greatest honour.

With my respectful compliments to Mrs. Wedgwood and your son, I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

<sup>1</sup> This and the following letter, written in 1785, were not known to Dr. George Wilson. (See Introduction.) The originals are in possession of Sam: Timmins, Esq., Birmingham.

<sup>2</sup> The title of this paper was : "Experiments and Observations relating to Air and Water," read to the Royal Society, Feb. 24, 1785.

<sup>3</sup> Priestley alludes to the attempt made by the English Government to free Ireland from commercial restrictions, a measure which Wedgwood opposed. See Wedgwood's reply, in next letter.

P. S. I have not yet received the tubes, etc., for which I wrote before I went to London; but while the sun shines so bright I cannot attend to anything else.

To JOSIAH WEDGWOOD, Esq., Great George Street, Westminster.

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## No. 35.

WEDGWOOD TO PRIESTLEY.

May 21, 1785.

DEAR SIR: I take the first vacant moment to thank you for the favor of your letter received a day or two ago, and for the three copies of your *paper of experiments*, which have not yet come to hand, but when they do shall be disposed of as you desire.

I congratulate you on the fine weather, and the important discoveries it has enabled you to make; but after so long and so close application I hope a few days' respite will be agreeable to you; and that you will be contented for our sakes to spare the sun for a little time and let some more rain fall.

I shall be happy in receiving specimens of your new modifications of metals, not in London, but at Etruria—for here I can look at nothing and think of nothing but Irish affairs, and if I do think of anything, and if I had them here, I should certainly commit some Irish blunder about them. I thank you for your good wishes in respect to that business, and assure you that you are mistaken if you think I have been successful.

We have already convinced the minister of 16 capital errors in the arrangement, and he has now brought into the house a system so much altered, and with so many additions that it may be called a new one. The first consisted of 11 propositions: the present of 18, which 18 are passing the house one by one, and in every one of these new alterations and amendments are made before it passes. Only 3 of them have yet passed, and the debates upon each of these have been long indeed. If they do at length get through the house, Ireland

cannot acknowledge or know them ; and as she declared she would not admit an alteration of a single iota, she must certainly herself reject what one party is laboring so hard to provide for her, and the other to keep from her.<sup>1</sup>

I am sorry for your disappointment in respect to the tubes, but as the sun has been so favorable as to prevent the want of them from being much felt hitherto, I will do what I can to prevent that want from continuing much longer, so that between us both I hope we shall be able to keep you easy ; that is to say, usefully employed.

[Signature wanting.]

[No superscription.]

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No. 36

PRIESTLEY TO MATTHEW BOULTON.

FAIR HILL, Wednesday [June, 1785].

DEAR SIR: I enclose another letter from Dr. Elliot which I hope will be the last that he will trouble you with.

I hope you will excuse the liberty I take in asking a favour for one I. Maddocks who works at Soho, and is one of our Society.<sup>2</sup> He is fearful of speaking to you himself tho his

<sup>1</sup> The propositions, increased in number to 20, passed through the Commons and the House of Lords, but failed to pass the Irish House of Commons by a majority of nineteen. The Government then abandoned the bill. Miss Meteyard says in this connection: "The defeat of this measure to free Ireland from the commercial restrictions, so cruelly imposed upon her since the Restoration, was not without effects of a most beneficial character. The contest awakened attention to commercial rights and duties ; and the result made clear to the apprehension of both the ministry and the governing classes that England and Ireland must be united for an unfettered commerce to flourish between them. Wedgwood lost largely by the part he took against the Irish Resolutions ; his indirect trade may have not suffered so much, but the agencies known to be his perished literally for some years." (Meteyard's Wedgwood, II., 548.)

<sup>2</sup> The religious society worshipping at the New Meeting-House, of which Dr. Priestley was the pastor.

request seems to be so reasonable that *an old servant*, as he says he is, might not, I think have thought it much presumption to speak to you on the subject. He says that his eyes have suffered exceedingly by his employment as a *chaser*, so that he cannot continue much longer and therefore he wishes to exchange it for some other that shall be less hurtful to him. I have seen a good deal of the man, and have a good opinion of him. He seems to be sensible, modest and conscientious. Confident that you are always ready to do what is right, and ever generous,

I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

MATTHEW BOULTON, Esq., Soho. Himself.

[*Endorsed*] Dr. Priestley with papers from Mr. Elliot concerning his various schemes. June 1785. Ans'd Aug. 17th.

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No. 37.

PRIESTLEY TO MR. J. JOHNSON.<sup>1</sup>

Jan. 21, 1786.

DEAR SIR: I am really sorry to give you so much trouble, but in the absence of Mr. Lindsey<sup>2</sup> I cannot so well avoid it. I have lately seen a catalogue of Lowndes,<sup>3</sup> tho' I cannot just now lay my hands on it, in which there is a *Français Concordant*, 2 vols. at 12/. I wish you would endeavor to get it for me.

<sup>1</sup> "Joseph Johnson, No. 72 in St. Paul's Church Yard," was the publisher of Dr. Priestley, who frequently refers to him in correspondence. An allusion to him in another Letter shows he also acted occasionally as Priestley's banker. Mr. Johnson (b. 1738, d. 1809) had the highest character for industry, integrity and unselfishness. (Timperley.)

<sup>2</sup> See Letter No. 40, note 3.

<sup>3</sup> William Thomas Lowndes (died in 1843), the English bibliographer.



If Dr. Heberden,<sup>4</sup> Mr. Lee<sup>5</sup> and Mrs. Rayner's names were not in my list of presents, of my last letter to Mr. Moseley, I shall be obliged to you if you will add them. The books for Hays are come very [safe]. I am obliged to you for your care of them.

With all our good wishes, I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

P. S. My daughter was married on Tuesday to a son of Mr. Finch and are now at Cambridge where his Father lives.

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### No. 38.

PRIESTLEY TO MRS. CROUCH.

BIRM. 3 Apr. 1786.

DEAR SISTER : Not pretending to be a judge in matters of *business*, I cannot tell what to think of Mr. Hope's scheme ; but as he is very confident of its success I see no reason why [I] should not accept of it. As you and Mrs. Priestley know one another, and have been happy together, there is the better prospect of our doing well. I sincerely wish it may answer for you both, and should be glad to contribute to it if I knew how ; I doubt not, however, but that my friends at Leeds

<sup>4</sup> See Letter No. 49, note 3, and Letter No. 4, note 1.

<sup>5</sup> Mr. John Lee of Lincoln's Inn ; he became Solicitor-General in 1782, and died in 1793, aged 60. Priestley made his acquaintance at Leeds, of which place he was a native. He was "exactly one week older than myself," says Priestley, who further writes : "Mr. Lee shewed himself particularly my friend at the time that I left Lord Shelburne, assisting me in the difficulties with which I was then pressed and continuing to befriend me afterwards by seasonable benefactions." Mr. Lee hinted to Dr. Priestley that he might have a pension from the Government, but he "declined the overture, wishing to preserve myself independent of everything connected with the court, and preferring the assistance of generous and opulent individuals, lovers of science, and also lovers of liberty." (Rutt, I., 216.) See Letter No. 74.

would give you any assistance in their power. Besides Fieldhead must now be disagreeable to you, and you will have agreeable society at Leeds.<sup>1</sup>

When you write next, as I hope you will as soon as you have settled your plan, I wish you would tell me the exact age of my uncle,<sup>2</sup> I imagine he must have been turned *ninety*. He was a remarkable man, and of a singularly happy constitution, both of body and mind. All that generation is now gone, and we who succeed them shall soon follow.

I suppose you did very well in giving the money to my brother as you did, I mean to do the same every year as long as they want it, and I can afford it.

With all our respects to yourself and to Mrs. Priestley, I am, Dear Sister,

Yours affectionately,

J. PRIESTLEY.

MRS. CROUCH, Fieldhead, near Leeds.

### No. 39.

#### PRIESTLEY TO KEIR.

FAIR HILL, Wednesday Morning [1786?]

DEAR SIR: I write to apprise you that *time is*, but that very soon *time will be past*. But to speak without allusions, my volume<sup>1</sup> will be nearly printed off this week; and if the

<sup>1</sup> This letter apparently alludes to a proposition of Mrs. Crouch to remove from Fieldhead, Priestley's birthplace, to Leeds.

<sup>2</sup> Doctor Priestley's father, Jonas, married the only daughter of Joseph Swift, of Shafton, a farmer and malster, and the Doctor was their first born. Jonas had seven older brothers and sisters, and reference is here made to John who died February 28th, 1786, aged ninety-two. A small portrait of John is in the possession of William O. Priestley, M.D., LL.D., of London. For some curious details of Dr. Priestley's early life, see "Authentic Anecdotes of the Life of my Brother, Dr. Priestley," in the "Funeral Sermon occasioned by the Death of the late Rev. Joseph Priestley," . . . by the Rev. Timothy Priestley, London, 1804.

<sup>1</sup> This probably refers to Priestley's sixth volume of "Experiments and Observations on Different Kinds of Air," published in 1786.

article you were so good as to promise, and by which I shall think my work much honoured, does not come the end of this week or the beginning of the next, it will be *too late*. I earnestly beg therefore that you will be as expeditious as possible. If you should happen to have it now ready, and could come and spend an hour or two with me, I should like to read to you a section I have composed on the theory of the experiments on air, but it will be in the hands of the printer on Friday or Saturday. I have also made several new experiments since I saw you, which I wish to talk to you about.

At all events I must, if possible, have your article, and I should think you might write it without repeating the experiment, if you have no doubt with respect to the general fact. Hoping to see or hear from you very soon,

I am, dear Sir, yours sincerely,

J. PRIESTLEY.

JAMES KEIR, Esq., Winson Green.

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No. 40.

PRIESTLEY TO BENJ. VAUGHAN.

BIRM. 2 March, 1787.

DEAR SIR: I thank you for the political intelligence you have sent me. I take very little interest in anything of this kind, and do not pretend to have any *opinion*, but I like to hear what is passing, and what is thought of public measures by those of my friends whose opinions have weight with me.

As I find there is a considerable number of books which you are so obliging as to intend to send me, for the purpose of revising my Lectures on History,<sup>1</sup> &c., and the period of my

<sup>1</sup> "Lectures on History and General Policy, to which is prefixed an Essay on a Course of Liberal Education for Civil and Active Life." London, 1788. These lectures are dedicated to Benjamin Vaughan, Esq., over the date Jan. 1, 1788. Priestley writes: "These Lectures were formerly addressed to you as a pupil . . .," refers to his "obligations to your father," and signs himself "your affectionate friend."

journey to London is at hand, you had better leave the selection of them till I come. It is very possible that I may not want quite as many as you will imagine. It is only an *elementary book* that I propose to make.

Three times I think I have informed you, that Dr. Franklin said he had sent me by Mr. Vaughan (I suppose he meant your father) *the new volume of their Transactions*.<sup>2</sup> If you have received it, I wish you would send it as soon as may be.

I hope you have received the copy I sent you by Mr. Lindsey<sup>3</sup> of my *Letters to a Philosophical Unbeliever*, Part II.<sup>4</sup> I shall be obliged to you if you will transmit another to Dr. Franklin and take it of Mr. Lindsey.

In about a fortnight I shall have finished all the printing I have at hand for this season, and then shall be looking toward London, before I engage in anything *new*, so that I shall probably be with you rather sooner than usual this year.

Mr. Vaughan is very obliging to invite my wife to come with me, but she cannot leave town at present. She will probably see London about midsummer.

We are all very well, and desire to be remembered to all the family.

Yours sincerely,

J. PRIESTLEY.

BENJAMIN VAUGHAN, Esq., Jefferson Square.

<sup>2</sup> Transactions of the American Philosophical Society, Philadelphia. Six volumes of Transactions were published between 1769 and 1809. After Priestley went to America he frequently contributed to its pages and attended the meetings of the Society.

<sup>3</sup> Rev. Theophilus Lindsey (born 1723, died 1808), a Unitarian divine of prominence, and a life-long friend of Priestley, who wrote of him: "Our correspondence and intimacy has been the source of more real satisfaction to me than any other circumstance in my whole life." (Rutt, I., 82.)

Rutt's *Life and Correspondence of Priestley* contains hundreds of letters written to Lindsey. See note, page 2.

<sup>4</sup> See Letter No. 1, note 2.

## No. 41.

PRIESTLEY TO WEDGWOOD.

BIRM. 26 Aug. 1787.

DEAR SIR : Since my last I have discovered, or rather re-discovered, the true regulus of manganese. For many years ago Dr. Withering procured it, but tho' he made many trials he was never able to succeed a second time. It is as soft as lead and most white. Dr. Withering says that his calcined and disappeared in the open air. I have five pennyweights of it, and shall preserve part of it for you, though I should not get any more. But I think I shall easily get it again. I got this by sending steam over some manganese red hot, and partly reduced in a former process.<sup>1</sup>

To complete the discovery may require a considerable consumption of your earthen tubes and retorts. But, in return, the repetition of the experiment by others will make a demand for them. Like a burning lens your tubes are capable of infinite uses in chymistry.



I want tubes in a different form from any that I have had yet, in order to make the vapour of different substances meet in a red heat ; thus, from *a* to *b* should be 21 inches. If I could have a dozen or two of them to meet me on my return

<sup>1</sup> The process described by Priestley could not possibly yield metallic manganese, which moreover is by no means "soft as lead and most white." The metal was first isolated by J. F. John, in 1807. For Dr. Withering see Introduction.

to Castlehead,<sup>2</sup> about a month from this time, I should be very happy.

I have made some curious experiments on the *terra ponderosa aerata*,<sup>3</sup> which is a scarce substance, tho' I hear there is plenty of it in Scotland. If you should happen to have any quantity of it by you, a pound or two of it would be very useful to me, as also would a piece or two of calk,<sup>4</sup> which is common enough.

Mr. More, who is with you, and is a kind of necessary man to all philosophers, may perhaps be able to procure the specimens for me. If any man can come at them *he* can, and I have often experienced his readiness to oblige me. I beg my compliments to him, and am, with much gratitude, and respects to Mrs. Wedgwood, and your son, Dear Sir,

Yours, sincerely,

J. PRIESTLEY.

No. 42.

WEDGWOOD TO PRIESTLEY.

[No place or date.]<sup>1</sup>

DEAR SIR: I thank you for the account of the very curious facts you have lately discovered, and am very happy in having

<sup>2</sup> The residence of Mr. John Wilkinson (see Introduction). On the very same day, Aug. 26, 1787, Priestley wrote another letter to his friend the Rev. Theophilus Lindsey, and says concerning his visit to Castlehead: "To-morrow I and my wife set out on a journey to Castlehead, where I spent a month about this time last year, and from which I returned so much recruited." (Rutt, I., 416.)

<sup>3</sup> The contemporary name for witherite or barium carbonate.

<sup>4</sup> Calk is the early name for the mineral heavy spar, or barite, barium sulphate. The early base of these minerals had been recognized as a distinct earth by Scheele, in 1774. Dr. Withering had published his "Experiments and Observations on the Terra Ponderosa," April 22, 1784. Wedgwood had secretly used these barium minerals in his manufactures since 1775. (Meteyard, II., 319.)

<sup>1</sup> Although this letter bears no date and no signature, it is obviously the reply of Wedgwood to Priestley's letter of August 26th; the writer complies with the request of the chemist for tubes with three ends, and

it in my power to assist the progress of your experiments by my manufactures. The tubes you desire with three ends are in the workman's hands, and I hope that they will meet you on your return from Castlehead, and I am to-day sending you the retorts and tubes you asked for some time ago.

I am very glad in that I am able to send you a little calk (all I have), which may possibly serve you until you can be supplied by some friend who has more of it than I have. Mr. More will inform you where you may procure some terra ponderosa aerated, as I have none in my possession. I congratulate you on your discovery of an easier method of getting the regulus of manganese, and shall be thankful for a small specimen of it, if you can spare it.

[No signature.]

[Endorsed] DR. PRIESTLEY, Aug. 25, 1787.<sup>2</sup>

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No. 43.

PRIESTLEY TO WEDGWOOD.

[No month; endorsed 1787.]<sup>1</sup>

DEAR SIR: Having been engaged in courses of experiments that did not require the use of earthen retorts, &c., I have not troubled you for a long time. But now, having many things in view which I cannot do without your assistance, I am obliged to have recourse to it. I shall thank you, therefore, for about *two dozen* of such *small retorts*, as you have hitherto supplied me, *glazed on the outside only*, and also as many *tubes*, 22 inches long, open at both ends, glazed in the

for a specimen of calk, and congratulates him on the isolation of metallic manganese. Perhaps the copy before us is a rough draft of the letter prepared for the private secretary to copy.

<sup>2</sup> The endorsement is apparently in Wedgwood's handwriting, but the date Aug. 25 is clearly an accidental error, for it antedates by one day the date of the letter to which this is a reply. The date should be the 28th or 29th of August.

<sup>1</sup> The endorsement is in the handwriting of Josiah Wedgwood as verified by his grandson Francis. (Wilson, p. 99.)

same manner. But I could wish them to have a slight bending in the middle, thus—



to prevent metals in fusion from running to the ends of the tube.

Having had the misfortune to break the two larger *mortars* I must beg the favor of two more.

The last sunshine that I had I made some experiments, which tend greatly to clear up the greatest difficulties I have laboured under when I published my last volume, viz: why pyrophorus should take fire with equal readiness in *nitrous* and *dephlogisticated* air. I find that iron heated in nitrous air becomes a *fiery cinder*, the same that it does in *dephlogisticated* air, and *steam*, so that they all contain the same common principle; and nitrous air appears to be a compound of pure air and phlogisticated air.<sup>2</sup> For this remains after the iron has become fiery cinder in it. I make the same change in nitrous air and iron, on a larger scale, by putting the iron into one of your earthen tubes, and sending the nitrous air thro' it red-hot by bladders at each end of the tube, pressing each of them alternately.

I am still greatly in want of a burning lens, and Mr. Parker is very dilatory in supplying me with one.<sup>3</sup>

On Monday next the Lunar Society is at my house. We expect Mr. Wilkinson, and should be happy if you could now and then be of the party.<sup>4</sup>

I am, Dear Sir, yours sincerely,

J. PRIESTLEY.

To JOSIAH WEDGWOOD, Esq., Etruria, near Newcastle-under-Line.

<sup>2</sup> Priestley's deductions from his experiments accord perfectly with present views, but the obsolete nomenclature nearly smothers his meaning. From the behavior of iron in nitric oxide, oxygen gas, and steam he concludes they all contain the same common principle (oxygen); and nitric oxide appears, he says, to be a compound of oxygen and nitrogen.

<sup>3</sup> Compare Letter No. 12, note 4.

<sup>4</sup> Probably John Wilkinson, Priestley's brother-in-law. See Introduction.



## No. 44.

PRIESTLEY TO WEDGWOOD.

BIRMINGHAM, 8 Jan. 1788.

d<sup>a</sup> = dephlogisticated.<sup>1</sup>

DEAR SIR: As the experiments in which I am now engaged promise to be of some consequence with respect to what has of late been the subject of philosophical discussion, I give you the earliest account of the probable issue of them.

They completely refute the hypothesis of d<sup>a</sup> and inflammable air composing *only water*. The decomposition of them always produces *acid*, and Dr. Withering finds it to be as yet in all cases the nitrous. They give reason to think that the great quantity of *water* that has been found in this case is nothing more than was diffused through the airs or was necessary to their aerial form. I almost conclude that water is the basis of all kinds of air. One of my experiments (on *terra ponderosa*) proves that it is a considerable part of fixed air, not less than one-third of its weight; tho' it has been thought to consist of nothing but d<sup>a</sup> and inflammable air.<sup>2</sup>

My experiments seem to render doubtful the conclusion that Mr. Cavendish<sup>3</sup> draws from his, as I get nitrous acid

<sup>1</sup> The abbreviation and explanation are given here exactly as in the original—at the head of the first page.

<sup>2</sup> This is a brief summary of the conclusions reached by Priestley, and soon after (February 7) embodied in an article which he read to the Royal Society under the following title: "Experiments and Observations relating to the Principles of Acidity, the Composition of Water and Phlogiston." (Phil. Trans. 1788, 147.) In this he records the formation of nitrous (nitric) acid, and acknowledges the assistance of Dr. Withering and of James Keir. Unfortunately for his reputation, Priestley's conclusions were quite erroneous; he never receded from his opinion that water is present in all gases, and that oxygen and hydrogen yield by their combustion nitrous (nitric) acid. "Priestley thus dissented alike from Cavendish, Watt, and Lavoisier, and totally abandoned his original doctrine, that inflammable and dephlogisticated air were entirely convertible into water." (Wilson.)

<sup>3</sup> Henry Cavendish (born October 10, 1731, died February 24, 1810), the illustrious English physicist and chemist, who has been frequently

from d<sup>a</sup> air without any that is phlogisticated. This is the case whether the d<sup>a</sup> air be got from manganese, red precipitate or red lead.

I should be happy if you could find time to give me a call as you go thro' Birmingham to show you my apparatus for these experiments. They are not yet completed, and they are very laborious as well as expensive. I shall soon proceed to diversify my process by the use of the excellent tubes you sent me, and shall not fail to give you an account of the result.<sup>4</sup>

Truly sensible of my manifold obligations to you, I am,  
Yours sincerely,

J. PRIESTLEY.

JOSIAH WEDGWOOD, Esq., Etruria, near Newcastle-under-Line.

[The wax seal bearing Priestley's crest and motto, is in an almost perfect state of preservation.]

named in the notes. For his part in the discovery of the composition of water, see Letter No. 22, note 3. For details of his life and labors, see Dr. Geo. Wilson's "Life of Henry Cavendish," London, 1851 (published by the Cavendish Society); also J. Clerk Maxwell's "Electrical Researches of Henry Cavendish," Cambridge, 1879.

Cavendish's views on the question at issue were communicated to the Royal Society, April 17, 1788, but since the experiments therein described were actually made in December, 1787, it is possible that Priestley was cognizant of them. Cavendish's paper is entitled: "On the Conversion of a Mixture of Dephlogisticated and Phlogisticated Air into Nitrous Acid by the Electric Spark."

<sup>4</sup> In corresponding with his literary and theological friends Dr. Priestley seldom intrudes scientific topics, but in a letter written to Dr. Price (Richard Price, b. 1723, d. 1791), the eminent dissenter and philosopher, and dated about a month earlier than the one under consideration, the chemist gives an account of his latest work:

December 4, 1787 . . . . "I forget what experiments I gave you an account of in my last. I have lately determined two things of considerable consequence; one is that a very great proportion of the weight of fixed air is water. This I have ascertained by the loss of water in the production of fixed air from *terra ponderosa*, which will not give any without water. The other which is of more consequence is that by the

No. 45.

PRIESTLEY TO KEIR.

BIRMINGHAM, 10th January, 1788.

DEAR SIR: Doctor Withering finds the acid I have lately procured to be, in all cases, nitrous,<sup>1</sup> even when the air was procured from the *red lead*. With what you were so obliging as to furnish me with formerly, and the stock I found I had of other red lead, I have now made a fresh and very large quantity of air,<sup>2</sup> which I am decomposing in a tin tube. The liquor is colorless, but the quantity of dark, colorless matter it brings off from the tin would astonish you. I wish much to see you, and am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

To JAMES KEIR, Esq., Smethwick.

decomposition of dephlogisticated and inflammable air (the former from manganese and the latter from iron with water) I get very little water, but a considerable quantity of acid which appears to be the vitriolic. I shall next use other kinds of pure and inflammable air" . . . . (Rutt, I., 423.)

It appears that, in December, Priestley thought the acid obtained by the union of oxygen and hydrogen was the "vitriolic" (sulphuric), but on January 8th, he writes to Wedgwood: "Dr. Withering finds it to be . . . the nitrous." And two days later he writes the same to Mr. Keir. It is possible that the word "vitriolic" is a slip of the pen, though it is evident that Priestley depended in some measure on Dr. Withering for analytical determinations.

<sup>1</sup> See preceding letter.

<sup>2</sup> Here "air" signifies oxygen.

## No. 46.

PRIESTLEY TO WEDGWOOD.

[Sept. —, 1788.]<sup>1</sup>

DEAR SIR: I have the pleasure to introduce to you the Chevalier Landriani, with whose name and merits as a philosopher you cannot be unacquainted.<sup>2</sup>

I have desired Mr. Johnson<sup>3</sup> to send you a copy of my *second paper* on phlogiston, just printed for the P. Transactions.<sup>4</sup> The only objection that was made to my conclusions was that the acid I got was from the *phlogisticated air*, which I could not exclude. But tho' I have the same result with *common air*, in which the phlogisticated air was in much greater abundance, the acid I got was much less. I have many things now on hand, but nothing has occurred of much consequence. I have, however, completely ascertained that spirit of nitre acquires colour by *heat* without light, and by simply giving out pure air, without imbibing anything, and I have made the experiment in all the kinds of air.

I have lately had a robbery in my laboratory, by which I have suffered, though to no great amount, and the thieves

<sup>1</sup> This letter is endorsed "Sept. 1788," in the handwriting of Chisholm [?], but again erroneously, for a comparison of this and the next succeeding letter, dated August 18th, shows that the letter dated "Sept." should be July, or, perhaps, early in August; this is proved by the words "since my last by Mr. Landriani," in Letter No. 47.

Dr. George Wilson, who had a few of these letters under review when writing his *Life of Cavendish*, refers to a letter dated March 18th, 1788, which is not found in the package as loaned to us. Dr. Wilson quotes one brief passage from the missing letter: "These experiments I cannot help thinking prove the decomposition of water to be a fallacy, and establish the doctrine of phlogiston."

While the letter of March 18th is missing, Letter No. 46 (erroneously dated Sept.) is at hand, but was evidently not in the collection examined by Dr. Wilson; at least no mention is made of it, and the biographer was particular to name the sequence of the series.

<sup>2</sup> Marsiglio Landriani. See Letter No. 31, note 4.

<sup>3</sup> See Letter No. 37, note 1.

<sup>4</sup> See Letter No. 47, note 5.

have gained nothing. My chief expense has been in guarding the place against a similar attack.

On my journey to London, when I meant to have paid the bill I owe you, I unfortunately lost it, together with some other papers, and though I went every place where I thought I might have left them, I could not secure them. I must therefore trouble your servants for a second copy, and Mr. Johnson shall discharge it immediately.

With my best respects to Mrs. Wedgwood and your son, I am, Dear Sir,

Yours, sincerely,  
J. PRIESTLEY.

P.S. I hope that the next time you come through Birmingham I shall not miss the pleasure of seeing you.

MR. WEDGWOOD, Etruria, near Newcastle-under-Line,<sup>5</sup>  
By the CHEVALIER LANDRIANI.

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No. 47.

PRIESTLEY TO WEDGWOOD.

BIRM. 18th August, 1788.

DEAR SIR: Such is the interest you take in philosophical discoveries, and such are my numerous obligations to you with respect to those that I had in this business, that I cannot help giving you an early account of everything I do that I think will give you any pleasure.

Since my last, by Mr. Landriani, I have greatly diversified my process for the decomposition of the different kinds of air, and see clearly the cause of the fallacy in Mr. Lavoisier's experiments and my own, in which we found *pure water*, when I now always find some *acid*. This was the *small quantity*, and the extreme *volatility* of the acid, owing to its high phlogistication. I can procure either pure water or a dry and condensed vapour at pleasure.

<sup>5</sup> Endorsed by Mr. Chisholm.

Mr. Berthollet,<sup>1</sup> suspecting the purity of my *precipitate per se*, desired I would send him a specimen of it. This I did, and he has sent me some in return, and with this I have a result much more favorable to my conclusion than I had imagined it would be. For, heating it in inflammable air, I find a considerable quantity of *fixed* air in the vessel.<sup>2</sup> This I had overlooked before, and ascribed the acidity of the drop of water to nitrous acid. I have the same result from using *minium*, which is a substance quite as unexceptionable as the precipitate, since it yields only pure air with heat. This process is therefore similar to that in which iron is heated in pure air. In this case the inflammable air from the iron uniting with the pure air in the vessel forms fixed air, and the same is formed by the union of the pure air from the precipitate or minium, and the inflammable air of the vessel.

The objection that Mr. Cavendish and Dr. Blagden<sup>3</sup> made to my experiments was that the acid I procured was from *phlogisticated air*; but this I have abundantly obviated, for in all the processes the more there is of this air (or of any other kind that cannot be decomposed by it) the less air I find.

<sup>1</sup> Claude Louis Berthollet, born Nov. 9, 1748, died Nov. 6, 1822, the eminent French chemist. With Lavoisier, De Morveau and others, the author of the new system of chemical nomenclature (publ. 1787), based on the antiphlogistic theory. The exchange of specimens between Priestley and Berthollet shows their rivalry was friendly, each seeking for the truth.

It appears that Watt and Berthollet also exchanged views on this question, for the Frenchman wrote to his friend on August 6 of this year an interesting letter in which he distinctly states that the acid formed was undoubtedly due to the "azote" of the atmosphere, or of the manganese ore used in preparing the oxygen. (Muirhead's *Mech. Inv. Watt*, II., 224.)

<sup>2</sup> How Berthollet's specimen of oxide of mercury could yield carbonic acid gas, provided the material was really pure, is incomprehensible. The way in which the result misleads Priestley is evident.

<sup>3</sup> Sir Charles Blagden (b. 1748, d. 1820), physician in the Royal Navy; Secretary of the Royal Society from May 5, 1784. For his part in the Water-Controversy, see Muirhead's *Life of James Watt*, London, 1858, pp. 343-355.

On Monday I set out on a visit to Mr. Galton<sup>4</sup> at the sea-side, near Exeter, having some little occasion for it on account of my health. Hoping to hear a good account of yours,

I am, Dear Sir, yours sincerely,

J. PRIESTLEY.

P. S. I desired Mr. Johnson to send you a copy of my Additional Observations,<sup>5</sup> with one for Mr. Darwin.

To JOSIAH WEDGWOOD, Esq., Etruria, near Newcastle-under-Line.<sup>6</sup>

### No. 48.

PRIESTLEY TO BANKS.

BIRMINGHAM, Aug. 18, 1788.

DEAR SIR: As you were so obliging as to transmit to me the *precipitate per se*, sent to me from Paris by Mr. Berthollet, I take the liberty to inform you, that the experiment I have made with it is decidedly in favour of my former conclusion, that water is not a composition of pure and inflammable air, but, as far as we yet know, a simple substance.<sup>1</sup>

Heating it in inflammable air did not, however, produce *nitrous acid*, as I had conjectured, but *fixed air*, in a considerable quantity.

The same was also the case when I used *minium*, a substance as unexceptionable as precipitate per se, since it yields nothing but the purest air by heat.

<sup>4</sup> Samuel Galton, see Lunar Society in Appendix. Of him Priestley writes: "Seldom, if ever, have I known two persons of such cultivated minds as Mr. and Mrs. Galton. The latter had the greatest attachment imaginable to my wife." (Rutt, I., 217.)

<sup>5</sup> "Additional Experiments and Observations relating to the Principle of Acidity, the Decomposition of Water and Phlogiston. With letters to him [Priestley] on the subject by Dr. Withering and James Keir. Read May 1, 1788. (Phil. Trans. 1788, 313.)

<sup>6</sup> The endorsement is in the hand of Mr. Chisholm.

<sup>1</sup> This letter, bearing the same date as the preceding to Wedgwood, treats of the same facts and views. Priestley here takes pains to reaffirm that which we now know to be erroneous.

I have also made a variety of other experiments which, in my opinion, leave no room to doubt of the doctrine of phlogiston, and also clearly prove that the acid I produced before did not come from phlogisticated air as Dr. Blagden, and I believe Mr. Cavendish, supposed; but from the union of dephlogisticated and inflammable air.

These I shall digest into a paper, which I shall lay before the Royal Society, the affairs of which are superintended by you, Sir; with the greatest impartiality, and in a manner that, in all respects, does you the greatest honour.

I am, Dear Sir, your obliged humble servant,

J. PRIESTLEY.

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No. 49.

PRIESTLEY TO WEDGWOOD.

BIRMINGHAM, Oct. 9, 1788.

DEAR SIR: I should have written to you before this time to acknowledge the continuance of your generous benefactions<sup>1</sup> notwithstanding my wish to decline it but that when your son called upon me I had just written to you and had sealed the letter. That I did not persist in declining your subscription was owing to my not having as yet heard anything more from Mr. Wilkinson on the subject which I mentioned to you and to some others withdrawing their contributions, at the same time that my experiments were considerably expensive to me. I have also to acknowledge my receiving yesterday a quantity of porcelain tubes and other vessels for the purpose of experiments. I hope I shall make good use of them.

Since my last I have particularly attended to all the objections I could collect to my late experiments and have made many others which my friends think particularly deceive; and

<sup>1</sup> Wedgwood's annual subscription to Priestley for scientific experiments was 25 guineas. See Letter No. 4, note 1.



I have drawn up a *third* paper to send to the Royal Society,<sup>2</sup> but as their sittings are not yet commenced, and several of my friends will wish to see what I have done in a business so much agitated as the doctrine of phlogiston, I shall take a separate copy which I shall read to you in the first place if I knew when it will soonest find you. If you be in London I will send you the copy for the Society and shall beg the favor of your sending it to Dr. Heberden.<sup>3</sup>

I shall be happy to hear of the re-establishment of your health. I have lately suffered a good deal from . . . , but at present, I thank God, I am well as ever I was in my life. I am just returned from Dawlish near Exeter where I spent a fortnight with Mr. Galton and the next week I plan a visit to Mr. Tayleur at Shrewsbury and after that I shall sit down to business for the winter.<sup>4</sup>

With my best respects to Mrs. Wedgwood and your son,

I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.<sup>5</sup>

JOSIAH WEDGWOOD, Esq., Etruria, near Newcastle-under-Line.<sup>6</sup>

<sup>2</sup> "Objections to the Experiments and Observations relating to the Principle of Acidity, the Composition of Water and Phlogiston, considered; with further Experiments and Observations on the same subject." Read to the Royal Society, November 27, 1788. (Phil. Trans. lxxix., 7.)

<sup>3</sup> William Heberden, M.D., F.R.S., practising physician in Cambridge and London. Born 1710, died 1801. A medical author of note.

<sup>4</sup> Concerning this visit to Mr. Tayleur, Priestley wrote to his friend, Rev. T. Lindsey, under date of October 20, 1788: "I have been to pay Mr. Tayleur a visit at Shrewsbury; . . . My wife accompanied me; . . . we found the old gentleman quite as well as we expected. . . . Mr. Tayleur's generosity knows no bounds. He insisted on my accepting another hundred pounds." (Rutt, II., 12.)

<sup>5</sup> Wedgwood's reply to this letter exists, or did exist in 1855, and we are able to give a few extracts from it, taken at second-hand. The letter was in the possession of Mr. Francis Wedgwood, of Barlaston; it is in the handwriting of Mr. Chisholm and unsigned, yet internal evidence of its authenticity is abundant. The writer refers to "your good letter of

<sup>6</sup> The endorsement is in the handwriting of Chisholm.

## No. 50.

PRIESTLEY TO KEIR.

FAIR HILL, Thursday [1789].

DEAR SIR: I have always forgot to tell you that I have not the account of the Duc d'Ayen's<sup>1</sup> experiments that you once asked for, my *Memoirs* not reaching further than 1778.<sup>2</sup>

I send a letter I have just received from Mr. Kirwan, by which you will see that he is about to publish before he is sufficiently master of facts.

I am working like a horse at the new arrangement of my 6 vols. of *Experiments*. It is a tedious business.<sup>3</sup>

the 9th" (No. 49), and declines his friend's offer to send him a separate copy of his paper. The following passages then occur: "I must, therefore, once for all, beg your acceptance of my best thanks for the early communications, from time to time, of your valuable discoveries, which now become more and more interesting; and I most sincerely wish you health with every convenience for the prosecution of them. I cannot forbear expressing my particular satisfaction to find that my old favorite, phlogiston, is likely to be restored to its former rank in the chemical world. . . . Mr. Watt's conjecture of nitrous acid being *contained* in inflammable air, as the vitriolic is in sulphur, pleases me much, though I confess there is one circumstance which appears rather unfavorable to it; for I understand it to be by *combustion* that the acid is detached from the phlogiston, and one would expect the *nitrous* acid to be rather decomposed than developed by that process."

Dr. Wilson, to whom we are indebted for the above, remarks: "This letter is the only one from Wedgwood to Priestley of which I have any knowledge; the MS. from which I have quoted was probably a copy of the original." It is evident that Letter No. 63 was not in the collection examined by Dr. Wilson.

<sup>1</sup> Jean Paul François, duc de Noailles, and duc d'Ayen (1739-1824), was a colonel in the French army, who consecrated the leisure afforded by peace to the pursuit of science. His memoirs on chemistry and physics brought him admission to the Academy of Sciences; his map of Germany was long the best extant. After the events of 1791 he retired to Switzerland, where he resided thirty years, esteemed by all for his public and private virtues.

<sup>2</sup> This refers to the *Mémoires de l'académie des sciences*, published annually.

<sup>3</sup> Priestley's revision bears the title: "Experiments and Observations on Different Kinds of Air and other branches of Natural Philosophy con-

What do you think of an attempt to dedicate this work to the Prince of Wales? The King I shall never think of in any such light, nor the Prince, unless it be possible that he will be a real patron of science, and could look upon it in some other light than that of an honour to myself.

Yours sincerely,

J. PRIESTLEY.

No. 51.

PRIESTLEY TO KEIR.

Tuesday [1790?].

DEAR SIR: I enclose a letter from Doctor Blagden, which you will be glad to see. I here send a corrected copy of my paper, in which I enlarge a little on the subject of phlogiston. I think the doubts concerning it cannot subsist a year longer. The question will be determined one way or the other.

Yours sincerely,

J. PRIESTLEY.

TO JAMES KEIR, Esq., Smethwick.

No. 52.

KEIR TO PRIESTLEY.

[No date or place] 1790 [?].

DEAR SIR: I return you Dr. Blagden's letter with thanks for the pleasure of reading it. When you write to him, be so kind as to give him my thanks for his obliging communication respecting the freezing of the vitriolic acid.<sup>1</sup>

nected with the subject. In three volumes, being the former six abridged and methodized, with many Additions." London, 1790, 3 vols. 8vo. His reference to this task gives us the probable date of this letter.

<sup>1</sup> Keir had published a paper on the congelation of vitriolic acid in the Philosophical Transactions for 1787.

The more we discover of Nature, the further we are removed from the conceit of our being able to understand her operations.

I wish M. Berthollet and his associates would relate their facts in plain prose, that all men might understand them, and reserve their poetry of the new nomenclature for their theoretical commentaries on the facts.<sup>2</sup>

I have wished much to call on you to hear of the progress of your experiments, but have been much indisposed with the rheumatism. I long to know what acids you get with the other inflammable airs. If you get different acids from the inflammable air made from sulphur and water, that made from marine acid and copper (for I would avoid iron on account of its plumbago and carbon), and that made from charcoal and water:—I say, if these acids are different (suppose, according to my notions, vitriolic, marine, and fixed air), then will you not be obliged to admit that there is not one inflammable but many inflammables, which opinion you now think as heterodox as the Athanasian system.<sup>3</sup>

However, there are wonderful resources in the dispute about phlogiston, by which either party can evade, so that I am less sanguine than you are in my hopes of seeing it terminated. One consolation remains, that in your experiments you cannot fail of discovering something perhaps of as great or greater importance for us to know.

[Signature not given.]

<sup>2</sup> This refers to the new French nomenclature proposed three years before by De Morveau, Lavoisier, and others, and already in common use on the Continent, but which was "poetical" to the adherents of phlogiston.

<sup>3</sup> Nine years later Priestley discovered carbon monoxide, as distinguished from hydrogen, thus confirming Keir's views.

## No. 53.

PRIESTLEY TO SIR JOSEPH BANKS.

72 ST. PAULS, 25 April, 1790.

DEAR SIR: As I wish always to act with openness, and to avow the motives of my conduct, I cannot forbear to express my great dissatisfaction at the conduct of the *Royal Society* in the rejection of Mr. Cooper,<sup>1</sup> recommended by myself and four other members, all men of science, and of respectable character. There is not, I believe, another example of a certificate so signed, and so slighted; the votes, as I hear, being twenty-four against him, and twenty for him.

My mortification is the greater, because it was in consequence of *my* proposal that Mr. Cooper became a candidate; and as *I* was known to interest myself in the business, by writing in his favour to both the secretaries, and to my other friends in the Society, I consider the proceeding as including in it an *intended affront to myself*.

Mr. Cooper, who was introduced to yourself, and whose merit, independent of his certificate, was attested by persons who have long known him, is a man equally distinguished for his knowledge, ability, and activity, and of all the persons that I know, I think him the most likely to do honour to any society of which he shall become a member.

I consider this business as the effort of *party spirit*, political

<sup>1</sup> Thomas Cooper, born October 22, 1759, died in South Carolina, May 11th, 1840, was an eminent natural philosopher, and later a politician. He sympathized with the liberal party in England, and after the outbreak in Birmingham in 1791 emigrated to the United States. There he filled successively the chair of chemistry at Dickinson College, Carlisle; the chair of mineralogy and chemistry at the University of Pennsylvania; and the chair of chemistry in the College at Columbia, S. C. Of the latter institution he became president in 1820. In 1834 he represented the people in the State Legislature. Though not eminent as a man of science, he was possessed of an active and comprehensive intellect. In this and the following rather sharp letters, Dr. Priestley takes it much to heart that Mr. Cooper was rejected by the Royal Society. (Compare Letter No. 28.)

or religious, highly *unworthy of the Society*, injurious to the interests of philosophy, and arising from principles which would equally lead to my own exclusion from the Society. But as I conceive it to be a matter in which you, Sir, had no concern, it does not, I assure you, diminish my respect for yourself, thinking, as I have always professed to do, that the Society is honored by your being its President.

I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

TO SIR JOSEPH BANKS, BART., Soho Square.

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No. 54.

PRIESTLEY TO SIR JOSEPH BANKS.

72 ST. PAULS, 27 April, 1790.

DEAR SIR: I am far from having any design of bringing the rejection of Mr. Cooper by the Royal Society "before the Public," or even of drawing you into a correspondence on the subject. I do not desire any answer to this letter. But for my own vindication with respect to the former, I would observe that I have known Mr. Cooper eight or nine years; Mr. Kirwan and some others, who signed his certificate, have known him, I believe, longer, and we all consider him in the same light, as also do many others in and out of the Society. It is acknowledged that other persons may have known him longer and better. But then civility, I think, required that some of us should have been informed of their objections to him before the day of balloting, that they might either have been removed, or the certificate withdrawn; since the rejection of a candidate is an unpleasant thing, both to the person recommended and the persons recommending him.

Dr. Crawford tells me that he had some conversation with yourself on the subject of Mr. Cooper not long before the balloting, and that he entertained no suspicion of any difficulty in the way of his election. Had the objections occurred on the

very day of balloting, the Society, I doubt not, would have deferred the ballot till proper enquiry could have been made concerning them.

But none of us having had the least intimation given us of any objection to Mr. Cooper, and having the highest opinion of his merit as a philosopher, naturally (tho' perhaps not justly) concluded that the objection to him rose from some other source, and therefore, whatever it was, it was unworthy of philosophers.

You say that "no token of Mr. Cooper's scientific merit has hitherto been brought forward to the Society." But is this the case of more than perhaps one in ten of the members, especially of gentlemen of fortune, and liberal education, like Mr. Cooper? He has, however, in his volume of *Essays* given proof of the greatest mental ability, and of his knowledge of chemistry, and how few are there in the Society whose merit of any kind, especially previous to their election, is known to the Society, or to the Public?<sup>1</sup>

I am with great respect, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

SIR JOSEPH BANKS, BART., Soho Square.

<sup>1</sup> In consequence of the rejection of Mr. Cooper by the Royal Society, Dr. Priestley ceased sending his philosophical papers to that Institution. The disturbances in Birmingham intensified the growing distrust of the members of the Society, and their rejection of another candidate "merely on account of his supposed political principles," as Priestley claims, decided him "not to trouble the Society" with his scientific papers. Accordingly, he issued his "Experiments on the Generation of Air from Water" in pamphlet form, preceded by a dedication to the Members of the Lunar Society, and dated Clapton, Nov. 16, 1793.

No. 55.

PRIESTLEY TO WEDGWOOD.

[Oct., 1790.<sup>1</sup>]

DEAR SIR: I am sorry that it was not in my power, during my late excursion, to execute your commission respecting your relative at Scarborough. Mr. Russel<sup>2</sup> had left that place and the coast before I reached Leeds, so that I did not proceed any farther as I intended to have done when I had the pleasure of seeing you at my house.

My chymical pursuits have been directed to the great question now depending on the decomposition of water, &c. But still, whether I decompose the two kinds of air by one explosion in a copper tube, or by a slow burning as the manner of the French, I never fail to produce acid, though they now say they find none at all, and even have made ounces of water perfectly pure. The air I use is not so pure as theirs, but the purer my air is, the more acid I always get.<sup>3</sup>

Please to tell your son<sup>4</sup> that tho' my journey and other avocations have made me seem to forget the obliging request he made me respecting the catalogue of books, he shall soon hear from me on the subject.

In the meantime, with my best wishes to him, and all your family, I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.<sup>5</sup>

JOSIAH WEDGWOOD, Etruria, Newcastle-under-Line, Staffordshire.

<sup>1</sup> This date was added by Mr. Chisholm, Wedgwood's private secretary.

<sup>2</sup> See Letter No. 7, note 4.

<sup>3</sup> Priestley reiterates the erroneous doctrine, although Cavendish had shown in 1784 that the conditions for the production of nitric acid were excess of oxygen, a moderate proportion of hydrogen and a very small one of nitrogen.

<sup>4</sup> Josiah Wedgwood had three sons: John, born 1766, Josiah, b. 1769, Thomas, b. 1771. It does not appear to which of these Priestley refers, but he corresponded at a later date with Thomas. (See Letters Nos. 59, 66, 73, 75, 76.)

<sup>5</sup> Between the dates of Letters Nos. 55 and 57 Priestley published: "Experiments on the Phlogistication of Spirits of Nitre." Read to the



## No. 56.

PRIESTLEY TO KEIR.

FAIR HILL, Friday [1791 ?].

DEAR SIR: I wish very much to see you, having got a quantity of *green liquor*, by air from the *lead ore*, which I wish you to examine with me. I have also other things to *show* and to *tell* you, especially what I think a *coup de grace* to the new doctrines.

Yours sincerely,

J. PRIESTLEY.

JAMES KEIR, Esq., Smethwick Grove.

## No. 57.

PRIESTLEY TO WEDGWOOD.

BIRM., Feby. 16, 1791.<sup>1</sup>

DEAR SIR: I informed your son that I was planning some experiments, and shall soon acquaint you with the result of them. I have completed these, and they have abundantly answered my expectations.

It was objected, tho' on insufficient grounds, to my former experiments, that the *acid* I produced came from *phlogisticated*

Royal Society, March 26, 1789. Also: "Experiments on the Transmission of the Vapour of Acids through an hot earthen tube, and further Observations relating to Phlogiston." Read July 2, 1789. Also: "Observations on Respiration." Read Feb. 25, 1790. And Wedgwood published: "On the Analysis of a Mineral Substance from New South Wales." Read April 15, 1790.

<sup>1</sup> On the same day that this letter was written Priestley wrote to his friend Dr. Price: "I shall soon send to the Royal Society, through your hands, or those of Dr. Heberden, a paper of new experiments in which I produce acid by the explosion of dephlogisticated air, without any mixture of phlogisticated air whatever." (Rutt, II., 103.) And on the 18th of February he writes to Rev. T. Lindsey: "I have just made an experiment of great consequence, . . . it proves that water and the nitrous acid consist of the same elements. I shall lay it before our Lunar Society on Monday." (Rutt, II., 102.)

*air* that was necessarily mixed with the dephlogisticated that I made use of. But I now, with great certainty, make air so pure, that I am confident it contains no mixed phlogisticated air whatever, and yet the explosion of this air with a due proportion of inflammable air, produces more acid than when the air I used was less pure. I also use no air pump, filling my copper vessel with water, and displacing it by the mixture of air to be exploded.

Admitting therefore, what I am not disposed to dispute, that the slow combustion of the two kinds of air by the French philosophers<sup>2</sup> produces nothing but the purest *water*, it must be admitted that a different mode of combining the same elements, in my process, makes *nitrous acid*. A comparison of the two results will give rise to much important speculation.

I procure the pure air by dissolving mercury in nitrous acid, and heating the yellow mass formed by it, without even suffering the red precipitate to come in contact with the common atmosphere, from which I suppose it attracts phlogiston.<sup>3</sup> Whereas the French experiment makes nothing against the doctrine of phlogiston, as it only proves that it enters into the composition of water.

With my best respects to your son and all your family, I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

P. S. You will be glad to be informed that my eldest son has found a promising situation in Manchester.<sup>4</sup>

JOSIAH WEDGWOOD, Esq., Hetruria, near Newcastle-under-Line.<sup>5</sup>

<sup>2</sup> *Mémoire sur la combustion du gaz hydrogène dans des vaisseaux clos*, par Fourcroy, Vauquelin et Seguin. Lue 21 Mai, 1790; *Ann. de chim.* viii. 230, and ix. 30. These chemists announced that when the combustion of hydrogen proceeded slowly no nitrous acid was formed.

<sup>3</sup> If the "yellow mass" obtained by dissolving mercury in nitric acid retained any basic nitrate, or any of the acid itself, the existence of nitrogen in the "pure air" (oxygen) is easily explained.

<sup>4</sup> Joseph, who afterwards emigrated with his brother to Pennsylvania.

<sup>5</sup> The endorsement is in the handwriting of Mr. Chisholm,

No. 58.

PRIESTLEY TO WEDGWOOD.

BIRM., Feb. 26, 1791.

DEAR SIR: Knowing the interest you take in matters of philosophy, I thought it would not be displeasing to you to know the late results of my late experiments, especially what is really curious. I can at pleasure make either *nitrous acid*, or *pure water*, with the same materials, viz., dephlogisticated air and inflammable air. If there be a surplus of the d<sup>d</sup> air, the result is always acid, if of the inflammable air, it is mere water. Extraordinary as this is, it is uniform, so that both Mr. Lavoisier<sup>1</sup> and myself have been right. The doctrine of *phlogiston*, however, stands firm; as it only appears that it is one element in the composition of water.

I shall send a paper on this subject to the Royal Society in the beginning of next week.<sup>2</sup> It will decide this long contest.

With my best respects to Mrs. Wedgwood, and your sons, I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

P. S. My eldest son is at length fixed at Manchester, and I hope to advantage.

Have you seen Mr. Paine's answer<sup>3</sup> to Mr. Burke?<sup>4</sup> It is

<sup>1</sup> See Letter No. 3, note 4.

<sup>2</sup> "Farther Experiments relating to the Decomposition of dephlogisticated and inflammable Air." Read April 7, 1791. In this Priestley concludes that Cavendish is wrong in supposing the nitrous (nitric) acid comes from the oxygen and nitrogen, and asserts it comes from the oxygen and hydrogen, "which makes it doubtful if these two kinds of air form pure water." (Phil. Trans. 1791.) This paper was sent to the Rev. Th. Lindsey on February 28th, with a request to deliver it to Dr. Heberden. (Rutt, II., 103.)

<sup>3</sup> This refers to Thomas Paine's Essay on the "Rights of Man," published in London in 1791, in reply to Burke's "Reflexions on the French Revolution."

<sup>4</sup> Edmund Burke, 1730-1797, the English orator, statesman and philanthropist. His "Reflexions on the French Revolution" was published in November, 1790. Priestley himself issued a pamphlet in reply, and in consequence was attacked by Burke in a speech in the House of Commons.

most excellent, and the boldest publication that I have ever seen.

JOSIAH WEDGWOOD, Etruria, near Newcastle-under-Line.

No. 59.

PRIESTLEY TO THOMAS WEDGWOOD.<sup>1</sup>

BIRM., June 20, 1791.

DEAR SIR: I like very much the plan of experiments that you mention, as they will very probably throw some new light on a very important subject, about which we as yet know very little. Indeed *Light* and *Heat* are little known, and yet I think they are as open to investigation as *air*. The experiments will no doubt be labourious, but nothing of value is to be had without labour,<sup>2</sup> and in that long attention to our subject which they oblige as to new views will often arise, relating not only to that but to other things. I shall be very glad to hear of the progress you make.

You are very kind in inquiring after the subscription to the expense of my experiments. It is, of course, variable, both on account of deaths and caprice, but I am far from having reason to complain, and your father's uncommon generosity makes it impossible for me to receive anything more from the same family.<sup>3</sup>

I should on several accounts be very happy to see you, and I hope if you can continue to come this way, you will be so good as to spend some time with me.

I am, Dear Sir, yours sincerely,

J. PRIESTLEY.

To MR. THOMAS WEDGWOOD, Etruria, near Newcastle-under-Line, Staffordshire.

<sup>1</sup> This letter to Josiah's son Thomas (born 1771), is evidently in reply to one communicating a plan of experiments on light. They resulted in two papers published by Wedgwood in the following year.

<sup>2</sup> Priestley's motto was, "*Ars longa, vita brevis.*"

<sup>3</sup> Josiah Wedgwood gave 25 guineas annually to aid Priestley in carrying on his investigations. (See Letter No. 4, note 1.)

## No. 60.

PRIESTLEY TO KEIR.

LONDON, July 22d, 1791.<sup>1</sup>

DEAR SIR: I am very happy to see a copy of your letter to the printer of the *Birmingham Chronicle*,<sup>2</sup> and in return enclose copies of my *Address to the Inhabitants of Birmingham*,<sup>3</sup> and of Mr. Russell's *Account of the Proceedings on July 14th*.<sup>4</sup> Both these have been in the London papers, and I have just sent yours to the printer of the *Morning Chronicle*.

I am happy to hear that all is quiet with you now, but when it will be proper for me to come to you I cannot tell. I fear not before the next Lunar Society. Whether I shall ever have it in my power to collect another apparatus for experiments is quite uncertain, as indeed is, in a great measure, my settling again at Birmingham, though there is no place in the world that I should prefer to it.

The extra copies of my last paper<sup>5</sup> for the Philosophical Transactions are printed, and I shall soon send some to Mr. Galton to be presented to each of the members of the Lunar Society.

<sup>1</sup> On the 14th July, 1791, a storm of popular rage against the party of Liberals who supported political and religious freedom broke with unexpected violence, and Priestley was one of the early victims of the "dreadful riots in Birmingham." We shall not here undertake to repeat the familiar story of the disgraceful and disastrous affair, but merely state that an enraged mob destroyed Priestley's house and contents, driving him from the town, which they sacked, almost unrestrained, for four days, inflicting damages to the extent of nearly one hundred thousand pounds. An interesting account by an eye-witness will be found in "The Life of William Hutton by Llewellynn Jewitt," London, n. d., pp. 215-249. (See also Rutt's Life, II., 115 *et seq.*)

<sup>2</sup> For Keir's letter see Appendix V., to Dr. Priestley's "Appeal to the Public," Birmingham, 1791.

<sup>3</sup> Priestley's Address was dated London, July 19th, 1791, and will be found in: Authentic Account of the Dreadful Riots in Birmingham, London, 1791. Republished with 8 views of the ruined houses, Birmingham, 1863. Long 8vo.

<sup>4</sup> Mr. Russell's letter will be found in the work last cited.

<sup>5</sup> See Letter No. 58, note 2.

I beg my compliments to them, and as long as I live I shall, with much satisfaction, think of our many happy meetings.

I am, in haste, Dear Sir, yours sincerely,

J. PRIESTLEY.

TO JAMES KEIR, Esq.

No. 61.

PRIESTLEY TO WEDGWOOD.

LONDON, July 26, 1791.

DEAR SIR: With this you will receive two copies of my *Paper for the Philosophical Transactions*,<sup>1</sup> one for yourself and the other for Mr. Moseley.<sup>2</sup> I fear I shall not soon be able to furnish materials for another. Indeed, what I shall do, or where I shall settle, is uncertain. I shall, however, continue at Birmingham *if possible*, and resume all my pursuits, in which case I must thank you for a fresh stock of *retorts, tubes, &c. &c. &c.* This invasion of the Goths and Vandals I little foresaw, and hope it will never be repeated, as I fancy the *experiment* will not be found to answer.

I also enclose a few copies of *Mr. Keir's letter*<sup>3</sup> and mine on the subject, and am, with my best respects to all your family, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

No. 62.

PRIESTLEY TO KEIR.

LONDON, 29th July, 1791.

DEAR SIR: I thank you for your kind letters. One Quaker at least, I find, did attend the Revolution dinner in

<sup>1</sup> See Letter No. 58, note 2.

<sup>2</sup> One of Priestley's benefactors. Cf. Letter No. 4, note 1.

<sup>3</sup> See Letter No. 60, note 2.

London.<sup>1</sup> One of the company told me there were more. This, however, I did not hear till I had got the correction you sent inserted in the *Morning Chronicle*.

I never thought of returning to Birmingham till my friends there should think it safe, and on their accounts advisable; and this, I now begin to fear, will not be so soon as you intimate. However, I am ready to attend the first summons, and earnestly wish it may be before the next Lunar Society. But your meeting must not depend upon this event.

With this I send each of you a copy of my late, and I fear *last* paper for the Philosophical Transactions.<sup>2</sup> I shall always recollect, with peculiar satisfaction and regret, our many cheerful and improving meetings; and if not a constant, shall indulge the hope of being an occasional attendant.

You were certainly a better judge than I was of the *spirit of the times*. But even you could not have expected such brutal excesses as have taken place; and yet I am willing to hope much from *time*, from your seasonable letter, and the representations of the more calm and reasonable members of the Church of England, if not from the interposition of government and the execution of the laws, in which I *wish* for moderation.

I lately dined with Mr. Sheridan,<sup>3</sup> who said I should meet Mr. Fox.<sup>4</sup> He, however, was prevented from attending, but desired Mr. Sheridan to say that he wished to take the matter up in whatever manner we should think proper, by motion in the House on the subject. They conceive that the encourage-

<sup>1</sup> The Birmingham rioters began by attacking a party of eighty gentlemen assembled for dinner at the Royal Hotel in Birmingham, in commemoration of the fall of the Bastille. Captain Keir was chairman on that occasion, but Priestley himself did not attend. It appears that another dinner was held the same day in London.

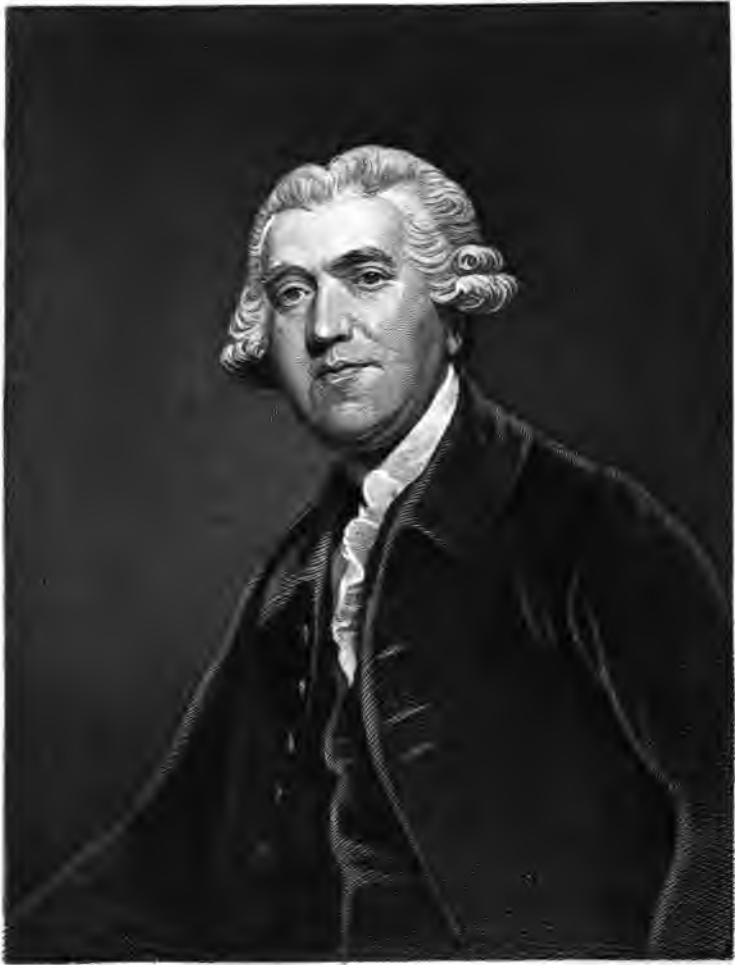
<sup>2</sup> See Letter No. 58, note 2.

<sup>3</sup> The celebrated Irish orator and dramatist (1751-1816) at this time represented Stafford in Parliament.

<sup>4</sup> Charles James Fox, the distinguished English orator and statesman, approved the French Revolution, at least in its first stages. He and Sheridan sympathized with Priestley in his losses, and supported him in his efforts to obtain compensation.







*Josiah Wedgwood.*





ment given to this High Church spirit by the Court arises from their willingness to crush Mr. Fox, who has taken our part, and that they hoped by these measures to intimidate us into silence. This I can hardly think to be the case, and I am unwilling to connect our cause with that of any political party; since upon the face of it, as you have clearly shown, it is wholly of a religious nature. However, I said there would be time enough to take our measures before the next meeting of Parliament.

I am, with my best respects to Mrs. Keir, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

TO JAMES KEIR, Esq., West Bromwich.

No. 63.

WEDGWOOD TO PRIESTLEY.

DR. SR.:<sup>1</sup> I do not know where this will find you, but can no longer forbear to ask you how you do, after the severe

<sup>1</sup> This letter is written on the back of the blank page of an old and torn letter addressed to Miss Wedgwood, Weymouth, and bearing also the words, "July twenty-fifth," and "W. Clive." It has a postmark, partly torn, with the distinctly legible date Jy 27 91. The letter sheet has been twice folded for filing and endorsed, first: "Miss Wedgwood, Weymouth," and secondly: "Dr. Priestley, 30th July, 1791."

The letter is obviously the first rough draft of Wedgwood's kind communication to Priestley immediately after hearing the news of the terrible riots in Birmingham. It bears the marks of much study in the choice of words, abounding in erasures, interlineations, substitutions, and additions, which we have attempted faithfully to show in our copy. Carets indicate the interlineations and words erased are denoted by being printed in smaller type.

The lower edge of the sheet on which this rough draft is written is torn in a very irregular way, but this was done prior to the writing, as is seen by the way in which the author wrote close to the crooked margin.

The place of writing is not given, but there is evidence that it was Weymouth; the letter of which the sheet is a part had been received in Weymouth July 27th, three days before Josiah Wedgwood used it; and the reply of Priestley (Letter No. 64) was addressed to Weymouth.

trials you have lately been expos'd to, and to condole with you on the irreparable loss you have so lately sustain'd from the brutality or rather, let us hope the temporary insanity of your late neighbours. You will have occasion for all your philosophy, and for all your xity\* too to bear up, support your mind under the highly aggravated injuries you have received. If it, they had arisen merely from the ungovern'd madness of a mob, from the lowest order of our species, one would have, then lamented its all its effects as one wou'd like those of a storm or hurricane, but when if there is reason to believe that the rabble were acted upon and employed, encouraged to such proceedings, by those who should be their superiors, one cannot help lamenting as well as despising the but perceive the too evident spirit, of the times or of the place at least, by which you and so many of your, worthy neighbours have suffered.

If you can think of anything in which I can serve or comfort you, you will oblige me in pointing out the way in which I can do it, & I hope you will believe me to be what I really am most desirous of most desirous of rendering you any aid, assistance or comfort in my power. Believe this of me, act accordingly & I shall esteem it as one of the strongest instances of your friendship. [In the original, this entire paragraph is erased by a vertical pen-stroke, and is followed by this substitute :—]

Can I be of any use or service to you upon the present occasion? Assure yourself, my good friend, that I most earnestly wish to do so it. Believe this of me—act accordingly, instruct me in the means of doing it & I shall esteem it as one of the strongest instances of your friendship. I shall be thankful to have a line from you whilst we continue here, which will probably be ten days or a fortnight longer, to tell me how you, Mrs. Priestley and any of your suffering friends who may be near you do. After the ingratitude as well as madness which the workmen of Birm<sup>m</sup>, for I wish to believe

\* Christianity.

that it reaches no higher, have shown to<sup>1</sup> Mr. Taylor,<sup>2</sup> the son of him who raised, I may say created, the manufactures by which they and their familys are have so long been & are still support'd, one cannot wonder at any other enormities they may commit. Pray God preserve you in safety—let me hear from you soon, & believe me most sincerely & affectionately yours,  
JOS.

P. S.—I read your letter in one of the papers with to the people of Birm<sup>m</sup>, and was highly pleas'd with it.

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No. 64.

PRIESTLEY TO WEDGWOOD.

[No place or date.] [July, 1791.]<sup>1</sup>

DEAR SIR: Your very kind and sympathizing letter was very acceptable to me. The shock was no doubt very great, but I thank God I have been able to bear it without any loss of health, or, indeed, of spirits. I begin to suffer most from want of employment and absence from my family, which indeed is irksome to me. My wife behaved with the greatest heroism at the time, but continuing in the neighborhood, and hearing continually of the bad spirit that prevails in the place, I perceived that her mind began to be affected by it. She cannot remove, for, as my daughter expects to be brought to bed in about a month, and she cannot bear that her mother should be absent at the time. This circumstance adds much to my difficulty. Could we go together to some distant place for a month, we should be much more comfortable. One good thing has already come out of this evil, I have a kind letter from Mr. John Wilkinson inviting us to any house of

<sup>2</sup> Moseley Hall, the property of John Taylor, Esq., was burned by the rioters, causing him a loss of £22,600. (Jewitt's *Life of Hutton*, p. 255.)

<sup>1</sup> This reply to Wedgwood's letter has been furnished the editor by Dr. Wm. O. Priestley, of London. The original is preserved in the Cambridge Free Library, to whom it was given by Swann Hurrell, Esq., of the same place.

his, and bidding me not to regard any losses that money can repair.<sup>2</sup> I wrote to you on my arrival here, with two copies of a *paper* of mine that is lately printed for the Philosophical Transactions, one for yourself and the other for Mr. Moseley.<sup>3</sup> I fear it will be long before I produce another. With my best respects to Mrs. Wedgwood,

I am, dear sir, yours sincerely,

J. PRIESTLEY.

JOSIAH WEDGWOOD, Weymouth.

[Written from the house of his son-in-law, Mr. William Finch,<sup>4</sup> Heath Forge, Birmingham.]

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No. 65.

PRIESTLEY TO WEDGWOOD.

LONDON, Sept. 7, 1791.

DEAR SIR: I am much obliged, and honored, by the attention that has been paid to me both at home and abroad.<sup>1</sup> My answer to the Address of the Academy of Sciences was first published in a very awkward garb from a double translation, but yesterday a friend of mine got it inserted as I wrote it in the Morning Chronicle.<sup>2</sup>

<sup>2</sup> Besides giving Priestley shelter, Mr. Wilkinson without solicitation sent him five hundred pounds immediately after the disastrous riots, and afterwards transferred to him ten thousand pounds which were in French funds; the latter being, however, non-productive at that period, Mr. Wilkinson further gave his brother-in-law an annuity of two hundred pounds. (Priestley's Memoirs, Rutt, II., 121.)

<sup>3</sup> See Letter No. 4, note 1.

<sup>4</sup> Mrs. William Finch, *née* Sarah Priestley, was the Doctor's only daughter.

<sup>1</sup> Dr. Priestley received immediately after the riots a large number of addresses and testimonials of esteem from his theological and philosophical admirers. In his Memoirs (London, 1806, vol. ii., 9), a list of twenty-six such addresses is given; some of these with Priestley's replies are printed in Rutt's Life, vol. ii.

<sup>2</sup> The address of the French Academy of Sciences was dated July 30th, 1791, and was transmitted by Condorcet. This address and Priestley's reply are printed in Rutt, II., 127.

I am glad to hear of the intended experiment at Paris, but am not able to give them any particular assistance, from any experience that I have had of the kind. I know nothing so likely to stand the action of their fire as *magnesia*. Everything else I think has been melted. I forget the greatest degree of heat that I ever produced; but it did not much exceed what you have mentioned, except when the clay and case were so melted, that I could not take any measure.

Your thermometer can no more give the degree of *real heat* than any other, if by heat be meant the *fluid* that is supposed to be the cause of heat. But all causes are ascertained by their effects. On this subject I had intended to make some experiments, though with no great expectation of discovering anything, and had provided myself with Dr. Crawford's apparatus<sup>s</sup> for the purpose, part of which you were so obliging as to supply me with, (viz., 4 vessels to heat acids in) when my laboratory was destroyed.

As what you generously gave to me, I am not obliged to give to the country, I shall be glad to know what I am to charge for the several articles you have furnished me with; viz., *retorts, tubes, mortars, evaporating vessels, levigators, Dr. Crawford's vessels*, and vessels 12 inches deep, with ground stoppers for a sand heat.

No attempt, I believe has been made to melt iron without the contact of air or steam. It is done with steel, but the fusion of iron converts it into finery cinder.

About the middle of next week I shall probably have the pleasure of calling on you at Etruria, if you will be at home, on my way to Castlehead, when I shall have much to say to you. My wife and son I hope will be with me.

With my best respects to Mrs. Wedgwood, and your family, I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

JOSIAH WEDGWOOD, Esq., Etruria, near Newcastle-under-Line,  
Staffordshire.

<sup>s</sup> Dr. Crawford, see Letter No. 27, note 2.



## No. 66.

PRIESTLEY TO THOMAS WEDGWOOD.

LONDON, Oct. 18th, 1791.

DEAR SIR: I do not know that any experiments have been made on the curious and important subjects that you mention, and I have little doubt but your labours in so new a field will be crowned with considerable success. All that is known of the kind is the great aptness of the more frangible rays to be *reflected* in such media as water, and the atmosphere.

Please to give my compliments to your father and brother, and tell them that I did not go the journey I proposed to do when I wrote before, or I certainly should have called upon you. I have taken a house at Hackney,<sup>1</sup> and am building a laboratory, and as soon as convenient shall be obliged to your father if he will supply me, as usual, with such retorts as you make, viz., *earthen tubes* closed at the end and open, and same with two necks. Small *retorts*, *evaporating-dishes*, *mortars*, and *levigators*. Perhaps your servants here can tell me the price at which I must estimate those that were destroyed by the riot. I must soon give in an account of my losses, and I fear that some person on your part must attend at Warwick to attest the value. Mr. Nairne,<sup>2</sup> Mr. Parker,<sup>3</sup> and others have promised to attend. But I have prepared a conference between my appraiser, and those for the County in London, which, if they be disposed to do justice, will save much trouble and expense.<sup>4</sup>

<sup>1</sup> Formerly the favorite suburban residence of London citizens; now in the heart of the East End of the town.

<sup>2</sup> Mr. Nairne, a philosophical instrument-maker; he constructed the largest electrical machines of the period on plans formed by Dr. Priestley. (Rutt, I., 79.)

<sup>3</sup> See Letter No. 12, note 3.

<sup>4</sup> Dr. Priestley's claim for damages amounted to £3628 8s. 9d., and of this only £2502 18s. were finally allowed by the court. Hutton says Priestley's real loss was upward of £4500. (Jewitt's Life of Hutton, p. 255.) In the town of Birmingham property to the value of £50,000

Whether I shall be invited to succeed Dr. Price,<sup>5</sup> is uncertain.<sup>6</sup> Many apprehend public disturbance in consequence of my coming. I could not get a house lot in my own name. A friend took it in his. I have, however, very handsome proposals from France, particularly the offer of a house completely furnished two miles from Paris, and another polite invitation from Toulouse, to take up my residence in the South of France in "a monastery which reason has recovered from superstition."<sup>7</sup>

I am, Dear Sir, with my respects to all the family,

Yours sincerely,

J. PRIESTLEY.

P. S. I shall leave for your father a new publication of mine, but only on account of the *Preface*.<sup>8</sup>

MR. THOMAS WEDGWOOD, Etruria, near Newcastle-under-Line,

Staffordshire.

was destroyed, of which sum £26,961 2s. 3d. was finally paid by a rate on the "Hundred," in which Birmingham is included. (Sam: Timmins, Trans. Midl. Inst. 1875.)

<sup>5</sup> Richard Price, D.D., F.R.S., an eminent dissenting minister and speculative philosopher, born 1723, died 1791. He was an intimate friend and correspondent of Priestley, as well as of Franklin, being deeply interested in natural philosophy. Priestley preached his funeral sermon at the Gravel-pit Meeting House, Hackney, on May 1, 1791.

<sup>6</sup> Priestley was invited to succeed Dr. Price in a letter from a Committee of the congregation, dated Nov. 7, 1791. Of his new situation he wrote: "On the whole I spent my time even more happily than ever I had done before, having every advantage for my philosophical and theological studies, in some respects superior to what I enjoyed at Birmingham." (Rutt, II., 118.) Aided by friends, his apparatus was in a great measure replaced, and some months later he resumed his experiments.

<sup>7</sup> See Letter No. 75, note 1.

<sup>8</sup> This refers to one of the chemist's theological writings which flowed from his pen as rapidly as if he gave all his time to the study of divinity. Since he issued six theological essays and two political ones in 1791, we are uncertain to which he here alludes.

## No. 67.

PRIESTLEY TO DR. WITHERING.

LONDON, Nov. 5, 1791.

DEAR SIR: I thought myself much obliged to you for your former letter, and should have written to you when I was a little more at leisure, and could have given you a better account than I am yet able to do of my probable future destination.

Your generous contribution towards the re-establishment of my philosophical apparatus cannot but give me satisfaction, tho' I am sorry to be so burdensome to my friends, especially my fellow-sufferers, among whom you are ranked. But what the country will do towards indemnifying us appears very distant and uncertain, and my claims will be liable to the greatest uncertainty, as the *proof* that may be required of my losses cannot be given.

I am happy to find that your alarms and sufferings have no more affected your spirit and health than my own did mine, and that we may so soon expect your third volume.

It will be a considerable time, with every assistance that money can afford, before I can be at work again, and hardly ever to so much advantage as at Birmingham. Such assistance from philosophical friends I should in vain look for here, and as long as I live I shall look back with pleasure and regret to our Lunar meetings, which I always enjoyed so much and from which I derived so much solid advantage. If I could find the same *intelligence* in any club of Philosophers here, I could not find the same *frankness*, which is the charm of all society.

I have nearly printed *An Appeal to the Public*,<sup>1</sup> on the subject of the late riot, and shall direct the printer to deliver you a copy.

I am sensible that it will more exasperate my enemies, but

<sup>1</sup> "An Appeal to the Public on the subject of the Riots in Birmingham," [etc.] Birmingham, 1791. 181 pp. 8vo. Another edition, London, 1792. Cf. Letter to Captain Keir, Letter No. 72.

it is addressed to our common judges, and may conciliate *them*, at least in a course of time.

I have lately written to Mr. Watt, and desired him, or the Lunar Society<sup>2</sup> as a body, to make a proposal to those who act for the country. I hope you will see the propriety of it, and contribute to its effect.

Still hoping to have the satisfaction of seeing you, and the rest of my friends of the Lunar Society, some time hence, and always to hear of your proceedings, I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

P. S. Mrs. Priestley joins me in best respects to yourself and Mrs. Withering.

DR. WITHERING, Birmingham.

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No. 68.

PRIESTLEY TO WEDGWOOD.

CLAPTON, November 22, 1791.

DEAR SIR: I have desired the printer to send you a copy of my *Appeal*<sup>1</sup> on the subject of the riots, in order to have

<sup>2</sup> See the Lunar Society in Appendix to this volume.

<sup>1</sup> See Letter No. 67, note 1. Dr. Priestley had sent part of his "Appeal" in sheets to his intimate friends in Birmingham, among others, Mr. Galton, Dr. Withering, and Mr. Russel. These conferred with each other and with Mr. Keir and resulted in a communication to Priestley recommending suspension of its publication and alteration of some of the passages. Capt. Keir in particular wrote to Priestley on November 18th, 1791, firmly endeavoring to dissuade him from publishing the "Appeal" in its proposed form, stating that it would "irritate his professed enemies, and furnish them with a new source of abuse;" he also feared that "government would become more remiss in prosecuting the magistrates and in protecting the dissenters in future if they should meet with any passage that should give them offence." These remonstrances of his friends had the effect of causing Priestley to cancel eleven leaves of his "Appeal."

your opinion and advice with respect to publishing of it. Several of my friends in Birmingham, viz., Dr. Withering, Mr. Keir and Mr. Galton think that it had better be suppressed, or published with many alterations by way of softening. Others and especially my friends here, are for its speedy publication, or about the time of the meeting of parliament. In this state of suspense I beg your perusal of it and your free opinion. I think that if I write at all it should not be with less spirit than I have usually shown and that there is nothing more violent or offensive in *this* than in several of my preceding publications. But as others are interested in the event of this publication I am willing to be advised by them. When you have read the work please to return to me at *Mr. Johnson's No. 72 St. Paul's*.

On Sunday sen' night I began to preach at Hackney. I have begun to build, and am preparing to furnish, another *laboratory*, and the house I have, tho on other accounts too expensive for me, is very convenient for my purpose.

With my best respects to all the family I am, Dear Sir,  
Yours sincerely,

J. PRIESTLEY.

JOSIAH WEDGWOOD, Esq., Etruria, near Newcastle-under-Line,  
Staffordshire.

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No. 69.

PRIESTLEY TO DR. WITHERING.

CLAPTON, Dec. 2, 1791.

DEAR SIR: I feel myself much obliged by the interest you kindly take in my affairs, and the advice which you and my friends have given me with respect to my *Appeal*.

You were not, however, aware that I stood pledged to publish something under that title in the Preface to my letter to the Swedenborgians, so that the only question is *what* I should publish, and as the present Appeal, with your corrections, at one time gave you sufficient satisfaction, I am willing to think

that when thus corrected it may do. Mr. Russell has promised to read over the copy you corrected, which I much wish to see.

This publication of mine will, by no means, interfere either with *yours*, which will certainly be highly useful as Mr. Keir's, and you may take or abridge as much of my Narrative as you think proper, and on any idea that you like. On such an occasion as this, it will be expected that *all* parties will speak, and it would be extraordinary, indeed, if the sufferers were silent. This silence in my case would be open to a more unfavorable construction than any publication; for conditions exist which in my circumstances might be an apology.

I am much obliged to Mr. Johnson,<sup>1</sup> and hope that his kind interference will be of essential service. I had begun to despair of anything like *justice*. If the opposite party will hear reason, they will certainly save themselves much expense, as well as do themselves credit.

I am, Dear Sir, yours sincerely and gratefully,

J. PRIESTLEY.

DR. WITHERING, Birmingham.

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No. 70.

PRIESTLEY TO MRS. CROUCH.

CLAPTON, Decr. 29, 1791.

DEAR SISTER: I must trouble you this year to get a stamp and draw (or Mr. Hudson for you) on Wm. Vaughan, Esq.,<sup>1</sup> Mincing Lane, London, for the *fifteen pounds*, which I hope I shall as long as I live be able to remit to you at this time of the year. Draw at ten days' after the receipt of this, and I will take care to apprise Mr. Vaughan of it.<sup>2</sup> ||

<sup>1</sup> Probably the Rev. R. A. Johnson, F.R.S., of Kenilworth, a member of the Lunar Society.

<sup>1</sup> William Vaughan, to whom Letter No. 90 is addressed. See Introduction.

<sup>2</sup> Dr. Priestley has been charged with meanness or greed in accepting the pecuniary assistance of his opulent friends, but this is unjust to the ||

I wrote to you immediately after the riots in Birmingham, I think it was the next day while I was at my daughter's;<sup>3</sup> and I am sorry to find you did not receive the letter. It was a very [sudd]en and very calamitous event, but it pro[mises] to ter[minate] better than we could [have expec]ted. [Here the bottom of the letter is roughly torn off, which causes the preceding sentence and the following paragraph to be incomplete.]

. . . and a house, which, after some repairs, will, I hope, be all we can wish. It is in a very good situation and has every convenience for my experiments. I am very near the New College at Hackney, and I have undertaken to give lectures in experimental philosophy gratis.<sup>4</sup> Mr. Jones,<sup>5</sup> who gave those lectures before is gone to succeed me at Birmingham. I have not seen much of my brother,<sup>6</sup> and the measures he

modest and poor philosopher, who was unceasing in his grateful acknowledgments. In this and the following letter we learn that he was generous to his relations, poorer than himself, remembering his sister with an annual New Year's gift.

<sup>3</sup> Mrs. William Finch; compare Letter No. 64.

<sup>4</sup> Dr. Priestley's lectures on "Experimental Philosophy, particularly including Chemistry," of which he drew up "Heads," were published in 1794, with a dedication to the students of the New College. He also lectured on "History and General Policy," being the course he had composed at Warrington. All this work was voluntary, and of it Priestley himself writes: "In being useful to this Institution, I found a source of considerable satisfaction to myself; indeed, I have always had a high degree of enjoyment in lecturing to young persons, though more on theological subjects than on any other." (Rutt, II., 120.)

<sup>5</sup> Rev. David Jones, afterwards a lawyer of distinction, gave lectures on the philosophy of the human mind, as connected with education, the theory of morals, and on general history, while fulfilling his Christian ministry at Birmingham, where he was successor to Dr. Priestley. (Rutt, II., 177.)

<sup>6</sup> The Rev. Timothy Priestley, "minister of the Gospel," Jewin Street, London, as he styled himself, was a dissenting minister, whose theological views were radically opposed to Dr. Joseph, and occasioned friction. Timothy's portrait, by J. Bowring, was engraved by R. Clamp, and published by G. Thompson, June 18, 1792. He was the author of several theological works. For his opinion of Joseph, see the Sermon referred to in note 2, Letter No. 38.

takes are not calculated to promote much intercourse between us. Some time ago he put an advertisement into the Public papers to inform the world that the author of his *Notes on the Bible* was not Dr. Priestley, but his brother, and [the rest of the sentence is torn off]. I shall not despair of sometime or other seeing you here, and it will give both me and my wife much pleasure.

Give our best respects to Mr. Hudson, and believe me to be,  
Dear Sister, your affectionate brother,

J. PRIESTLEY.

Mrs. CROUCH, at Mr. Hudson's, Gildersome, near Leeds.

No. 71.

PRIESTLEY TO SIR JOSEPH BANKS.

CLAPTON, Jan. 10, 1792.

DEAR SIR: Having lost my whole stock of substances, ores, minerals, earths, etc. etc., for the purpose of experiments, and being willing to replace them as expeditiously as possible, I shall be obliged to you if you will mention my situation to any of your friends whose laboratories are furnished, and who may have any thing to spare to set up a broken philosopher.<sup>1</sup>

I shall take the first opportunity of doing myself the pleasure of waiting upon you, and am, Dear Sir,

Your very humble servant,

J. PRIESTLEY.

SIR JOSEPH BANKS, Bart., Soho Square.

<sup>1</sup> On the back of this letter is a memorandum by Sir Joseph, as follows: "Offered him black lead, menecanite, sand and clay from Sidney Cove, Adamantine Spar, green sand, garnet sand from India, do. do. from Greece, earth of Borax, Tabasheer."



## No. 72.

PRIESTLEY TO KEIR.

CLAPTON, 12th January, 1792.

DEAR SIR: Though I have not before found leisure to write to you, I was not insensible to your kindness and friendship in giving me your opinion with respect to my *Appeal*.<sup>1</sup> Had I not been actually pledged to publish, it would have had considerable weight with me; but this was a circumstance of which you were not apprized. I have, however, cancelled *eleven leaves*, in order to strike out passages that were thought to be unnecessarily offensive, and I am willing to hope that you will not find much to object to at present, especially as some other publications will have preceded it and made way for it, particularly *T. Sobersides*<sup>2</sup> in the humorous, and *High Church Politics*<sup>3</sup> in the serious way. Both these publications I greatly admire, and when they are read they must do much good. With respect to myself, I cannot help thinking that my silence, considering my *aptness to write*, would have borne an unfavorable construction, as would my writing with less spirit, or in any other manner than I had been used to do. You will receive a copy of the *corrected Appeal* about the same time that you receive this.

An ingenious young man, Mr. — Jones,<sup>3</sup> who lectured on Experimental Philosophy in the New College, is at Birmingham as my successor, and, I hear, gives great satisfaction. He will think himself happy in being noticed by any of my philosophical friends. I have undertaken to give his lectures, and some others, *gratis*; and this will be of some use to myself in obliging me to attend to the whole course of chemistry, with several branches of which I was but little acquainted. But having no substances to exhibit or to work upon, I shall long be at a loss and disabled from appearing to advantage. May I trouble you to furnish me with small quantities of the

<sup>1</sup> See Letter No. 68, note 1.

<sup>2</sup> These were political pamphlets by Captain Keir.

<sup>3</sup> See Letter No. 70, note 5.

articles you used to supply me with, as fossil alkali, minium, etc., etc., or anything else that you can conveniently spare.<sup>4</sup> I now want *everything*, and wish to get to work again as soon as I can.

I shall soon send you a copy of what I can recollect of the contents of my laboratory,<sup>5</sup> etc., and shall beg the favour of some of you to attend as witnesses of what you remember of them. But if *strict* proof be required I must go without indemnification.<sup>6</sup>

I am, Dear Sir,

Yours sincerely,  
J. PRIESTLEY.

No. 73.

PRIESTLEY TO THOMAS WEDGWOOD.

LONDON, Feb. 25, 1792.

DEAR SIR: There is nothing more within the field of random speculation and less within that of experiment than the subject of light and heat.<sup>1</sup> Their connection is evident, but which is the element of the other is unknown, and there have been other possible conjectures with respect to them and phlogiston too. I do not recollect anything worth pointing out to you on the subject except something, I do not know what, in Scheele's treatise on air and fire.<sup>2</sup> This I hope is a business reserved for you. It is a ground unopened.

<sup>4</sup> It should be remembered that Keir had a chemical manufactory at West Bromwich. ||

<sup>5</sup> See the Inventory in the Appendix.

<sup>6</sup> In a letter, dated January 11th, 1792, addressed to Mr. Russell, Dr. Priestley says: "I shall write to-morrow to Mr. Keir to satisfy him that I took nothing amiss in his letter." (Rutt, II., 177.)

<sup>1</sup> In writing to Thomas Wedgwood, Priestley resumes the subject alluded to in his letter of June 20, 1791 (No. 59).

<sup>2</sup> Scheele's "Chemical Observations and Experiments on Air and Fire" was translated from the German by Dr. J. R. Forster, and published in London in 1780. The volume is dedicated to Dr. Priestley by the translator, who acknowledges the encouragement and assistance of Priestley in prosecuting the work.

As I am under the necessity of being obliged to my friends in re-establishing my apparatus, I cannot have any objection to your assistance except the great and manifold obligation I am already under to your father.

I hope you have received the tubes that wanted *glazing*, and that I shall soon have them again with the other articles I took the liberty to request of you.

I am, with my best respects to all the family, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

P. S. I rejoice in the prospect of seeing you so soon.

[No superscription.]

### No. 74.

PRIESTLEY TO MR. LEE.<sup>1</sup>

CLAPTON, March 13th, 1792.

DEAR SIR: Mr. Galton and Miss Judith Mansell,<sup>2</sup> having written to us to recommend several persons as evidence at the approaching Assizes, I cannot help wishing that you would see them, and all the persons they recommend, that you may judge for yourself of the amount of their evidence, and select from among them whom you shall think the most proper, both with respect to their *household goods*, and my *books* and instruments. I am unwilling, on the one hand, to give my friends unnecessary trouble, and on the other, I would not neglect what may be really useful for enforcing my claims, and in the most respectable manner.

I am, Dear Sir, yours sincerely,

J. PRIESTLEY.

MR. LEE, Attorney-at-law, Birmingham.

<sup>1</sup> Probably Mr. John Lee, a long-time friend of Dr. Priestley. See Letter No. 37, note 5.

<sup>2</sup> An intimate friend of Dr. Priestley; for notice of the Mansell portrait of the chemist, see *The Likenesses of Priestley* in Appendix to this volume.

## No. 75.

PRIESTLEY TO THOMAS WEDGWOOD.

CLAPTON, 13 March, 1792.

DEAR SIR: I thank you for your generous, indeed, too generous, opulence towards replacing my philosophical apparatus. I hope now to be at work again very soon, at least to have everything in readiness against the conclusion of the assizes at Warwick, which I must attend.

I forgot to tell you that I do not know of any better kind of *Bologna Phosphorous* than that described by Mr. Canton.<sup>1</sup> That this phosphorous emits the very light it receives, I have not myself any doubt, though it has been questioned by some. But the particulars of the objection and answers I have now forgotten. The objections were made, I think, by Mr. Wilson.<sup>2</sup>

Since I wrote the above I recollected that I had mentioned this subject in some of my publications, and I find it in the preface to my second volume of *Experiments on Air*, as first published.<sup>3</sup>

I am, Dear Sir, yours sincerely,

J. PRIESTLEY.

MR. THOMAS WEDGWOOD, Etruria, near Newcastle-under-Line,

Staffordshire.<sup>4</sup>

<sup>1</sup> John Canton (1718–1772) was a teacher at an academy in London. His researches and published papers on electricity and natural philosophy are numerous. The phosphorescent compound named after him is described in "An easy method of making a phosphorous that will imbibe and emit light, like the Bolognian stone." (Phil. Trans., 1768.)

<sup>2</sup> Benjamin Wilson (1708–1788), member of the Royal Society and author of scientific essays. In his "Treatise on Phosphori," he criticises Priestley for a statement which was a mere clerical error.

<sup>3</sup> "Experiments and Observations on Different Kinds of Air. Second Edition." London, 1776. Vol. ii., Preface, pp. xiv–xviii.

<sup>4</sup> The endorsement is apparently in the hand of Thomas Wedgwood.

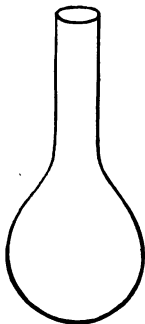
## No. 76.

PRIESTLEY TO THOMAS WEDGWOOD.

CLAPTON, May 5, 1792.

DEAR SIR: My journey to Warwick, and many other engagements, prevented my giving due attention to your paper<sup>1</sup> so soon as I should otherwise have done. But I have perused it with attention and pleasure, and think it a very proper addition to your former paper. I admire the ingenuity you have discovered in contriving to execute your purposes, and have no doubt but that by continuing to attend to your object, you will make considerable progress in the investigation of it, little as we at present know of it. I think, however, it might not be amiss to recompose some parts of your paper, in order to make the corrections of the observations in the former part of it unnecessary. But of this you will be the best judge yourself.

I am particularly obliged to you for your care to send me the articles I wanted. I have now everything that I imagine Etruria can furnish me with except some vessels in the following form



<sup>1</sup> "Experiments and Observations on the Production of Light from Different Bodies by Heat and Attrition." Thomas Wedgwood published two papers under the above title in the Philosophical Transactions for 1792. Wedgwood's experiments in photography made in 1791-93, were not published until 1802, and then under the name of Sir Humphry

the neck about nine inches and the bulb about three, some glazed and others unglazed ; and a few tubes with twin necks thus, unglazed.



If, at your leisure, you will please to furnish me with some, it will add to the many obligations I am already under to you, and your father. *Mortars*, and some other things, I understand I can have in Greek Street.

I am, Dear Sir,  
Yours sincerely,  
J. PRIESTLEY.

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No. 77.

PRIESTLEY TO LAVOISIER.

[HACKNEY], June 2d, 1792.

DEAR SIR : I take the liberty to introduce to you Mr. Jones,<sup>1</sup> who was lecturer in chemistry at the New College in Hackney, in which employment I now succeed him, and who is to be my successor at Birmingham. You will find him to be equally modest and sensible, and, as a philosopher, more inclined, I believe, to your system than to mine ; but open, as we ought all to be, to conviction as new facts present themselves to us.

The late riots have interrupted my experiments near a whole year, but I am now refitting my apparatus and about to re-

Davy. The article is entitled : " An Account of the Method of copying Paintings upon Glass, and of making profiles by the agency of Light upon the Nitrate of Silver. Invented by Thomas Wedgwood, Esq., with Observations by H. Davy." (Journal of the Royal Institution, June, 1802.) A facsimile of Wedgwood's heliotype taken at Etruria, in 1791-93, forms a frontispiece in Miss Meteyard's " Group of Englishmen."

<sup>1</sup> See Letter No. 70, note 5, and Letter No. 72.

sume my usual pursuits, and I shall not fail to give due attention to what you may advance in reply to my last memoir on the subject, a copy of which I sent you; and for this purpose I shall be glad to be informed concerning them. Mr. Jones will convey your sentiments to me.

In case of more riots, of which we are not without apprehension, I shall be glad to take refuge in your country,<sup>2</sup> the liberties of which I hope will be established notwithstanding the present combination against you. I also hope the issue will be as favourable to science as to liberty.

I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

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No. 78.

PRIESTLEY TO DR. WITHERING.

CLAPTON, Oct. 2, 1792.

DEAR SIR: I thank you for the third volume of your excellent Botanical work.<sup>1</sup> I should now have the whole complete, but that the rioters have deprived me of the *first volume*. One of the most disagreeable circumstances attending the riot, with respect to my *books*, is that the sets are almost all broken, so that if they consisted of three volumes or more, hardly any of them are complete.

I have been much concerned to hear of the alarming return of your disorder, but I hope that report has magnified the danger. It was said that you would be under the necessity of removing to a warmer climate.

One of the things that I regret the most, in being expelled from Birmingham, is the loss of your company, and that of the rest of the Lunar Society. I feel I want the spur to constant exertion which I had with you. My philosophical friends

<sup>2</sup> See Letter No. 79, note 1.

<sup>1</sup> This refers to the second edition of his: "Botanical Arrangement." See Introduction.

here are cold and distant. Mr. Cavendish<sup>2</sup> never expressed the least concern on account of anything I had suffered, tho' I joined a party with which he was, and talked with them some time. I do not expect to have much intercourse with any of them.

I have, however, nearly replaced my apparatus, and intend not to be idle. I have already made some experiments relating to the *doctrine of phlogiston*, and when I have made a few more shall probably write something on the subject. I am surprised at the confidence with which the French chemists write; but I cannot yet learn what they have to object to my last Paper in the Philosophical Transactions. A friend at Paris, at my request, applied to M. Lavoisier, and others, but got no satisfactory answer, but since the tenth of August he has absconded, and where he now is I cannot learn.

I was in hopes to have been able to pay my friends of Birm. a visit long before this time, but was always discouraged, so that I have now given up the thoughts of it, and must content myself with seeing as many of them as I can here. I should be very happy to see you, but fear I must despair of that satisfaction. I do not, however, think I shall continue here long. Tho' unwillingly I shall some time hence follow my son to France. But as I can *do* nothing there I will stay here as long as I can. I shall be very happy to hear from you, and with every good wish to yourself and Mrs. Withering, in which my wife joins me, am

Yours sincerely,

J. PRIESTLEY.

DR. WITHERING, Birmingham.

<sup>2</sup> See Letter No. 44, note 3.



## No. 79.

PRIESTLEY TO MRS. CROUCH.

CLAPTON, Dec. 31, 1792.

DEAR SISTER : I write to remind you of drawing upon *Mr. Wm. Vaughan, Mincing Lane*, for 15£ as usual, and at *ten days*. This is rather more convenient than any other method. Give our kind regards to our brother and sister, and let me know how they do.

We have lived very quietly and comfortably here, and hope to continue so, though the country is in a great ferment, and the Dissenters in general, and myself in particular, are sometimes threatened. Many I hear talk of going to France or America. One of my sons is in France, and I think it not unlikely that another may go thither, tho' not at present, and if so, and especially if there should be any disturbance in this country, I shall probably follow them ;<sup>1</sup> but not if I can help it, while I am capable of doing anything. For there I must be in a great measure idle. There is much talk of a war with France, but I hardly think it will take place ; we have so much to lose and so little to get by war.

My wife, on the whole, enjoys pretty good health ; but Harry<sup>2</sup> has been dangerously ill of a nervous fever, but is now recovered. They join with me in respects to you and Mr. Hudson. I hope that whenever he comes to London he will

<sup>1</sup> Priestley often thought of going to reside in France, where his scientific abilities were highly appreciated, his liberal views concerning government were admired, and his theological tenets would at least be better tolerated than in England. After the riots in 1791, he received some of the warmest tributes of esteem from France ; he was invited to become a member of the National Convention, to accept a furnished house near Paris, and even to reside in a monastery in the neighborhood of Toulouse. (See Rutt, II., 121, and Letter No. 66 ; and compare Letter No. 77.)

<sup>2</sup> Priestley had a daughter Sarah (afterwards Mrs. Wm. Finch), and three sons, Joseph, William, and Henry. Henry died at Northumberland, Pa., in 1795, just after his father had "fixed him in a farm and built him a house."

not fail to call upon me, and whenever it shall be convenient to you to come this way, we shall be happy to receive you as long as shall be agreeable to yourself.

I am concerned that I do not see my brother as I used to do. But after his advertising, as he did, against me, and making no apology for it, I don't think I can be blamed for not going to him first. I am told that he says it was the bookseller who did it. But it appears in his name, and he should have prevented it, or have disclaimed it afterwards.

I am, Dear Sister, your affectionate Brother,

J. PRIESTLEY.<sup>3</sup>

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No. 80.

PRIESTLEY TO DR. WITHERING.

CLAPTON, April 15, 1793.

DEAR SIR: I take the opportunity of Mr. Skey and Mr. Russell's<sup>1</sup> visit to Lisbon to congratulate you on the good accounts I have of your health.<sup>2</sup> I hope now that with care it will be thoroughly established, so as to bear your native climate. Many times have your friends been alarmed for you, but you have always understood your own disorder, and have happily hit upon the proper remedy.

I wish the country was in a better state to invite your return to it, but it is far otherwise, at least with respect to myself and those who have generally passed for the friends of liberty. Such is the spirit of bigotry encouraged by the Court party, that great numbers are going to America, and among others

<sup>3</sup> This letter has no superscription, but is obviously addressed to Mrs. Crouch.

<sup>1</sup> See Letter No. 7, note 4.

<sup>2</sup> Dr. Withering being an invalid sought the benefits of a warmer climate, and set sail for Portugal, October 24, 1792, returning on the third of June, 1793. His life was prolonged in spite of great debility until October 6, 1799. (See Introduction.)

all my sons, and my intention is, that when they are settled to follow them and end my days there. This will be a great mortification to me, after having replaced my apparatus, and recommenced my experiments, as I now have done. Indeed, to appearance, I have everything very comfortable about me, but I cannot get so much time to myself as I wish, and I have little intercourse with the members of the Royal Society.<sup>3</sup> On both these accounts I do less in my laboratory than I wish to do. The Lunar Society<sup>4</sup> was an unspeakable advantage to me, and I am unable to replace it here. I am not, however, quite idle, and somethings that I have done tend to confirm the doctrine of phlogiston. I cannot yet learn what the French philosophers object to in my last paper, and I have repeatedly applied to them for the purpose, so that I think with you that their *charbon* or *hydrogene* will prove to be nothing more than another name for *phlogiston*. Still, however, the question will be whether either of them be contained in *metals*, or make an essential part of *water*.<sup>5</sup>

Living in the neighbourhood of New College, I have given a course of lectures in chemistry, and have some thoughts of publishing the heads of my course for the students, and if I do, I shall add some observations on the new theory.<sup>6</sup>

I send you a second part of my appeal to the public on the

<sup>3</sup> Priestley, in his *Memoirs*, writing of his life at Hackney, says: "I found my society much restricted with respect to my philosophical acquaintance, most of the members of the Royal Society shunning me on account of my religious or political opinions, so that I at length withdrew myself from them." (Rutt, II., 119.)

<sup>4</sup> See Appendix.

<sup>5</sup> Priestley steadfastly adheres to his old views, and yet Lavoisier's admirable and clear "*Traité élémentaire de chimie présenté dans un ordre nouveau*," published four years before the date of this letter, contains a section, pp. 506-512, "on the combustion of hydrogen gas and of the formation of water," with quantitative results, which should have been convincing to any one not blinded by prejudice.

<sup>6</sup> This plan Priestley carried out. The volume bears the title: "Heads of Lectures on a Course of Experimental Philosophy, particularly including Chemistry; delivered at the New College in Hackney." London, 1794, 8vo.

subject of the Riots,<sup>7</sup> and some letters I have addressed to the Philosophers and Politicians of France.<sup>8</sup> Neither of them, however, I fear, will have much effect. We have not yet received any indemnification for our losses. A petition is before Parliament for leave to borrow the money and raise it at different times, as it is found to be impracticable to collect the whole at once, as the law requires, but Mr. Fox<sup>9</sup> will oppose it as contrary to the intention of the law, and what will be done I cannot tell.

We have no intercourse now with France, and whether my son William has been able to leave it and go to America I cannot learn. Indeed, the prospect is very melancholy. The conduct of the French has been such as their best friends cannot approve; but certainly the present combination against them, which does not appear to have any other object than the restoration of the old arbitrary government, is as little to be justified.

Wishing, though hardly hoping, for better times, I am,  
Dear Sir,

Yours sincerely,

J. PRIESTLEY.

DOCTOR WITHERING, Boulonois Hotel, Calçada D'Estrella, Lisbon [with two pamphlets].

<sup>7</sup> An Appeal to the Public on the subject of the Riots in Birmingham, Part II. To which is added a letter from W. Russell, Esq., to the Author. London, 1792.

<sup>8</sup> Letters to the Philosophers and Politicians of France on the subject of Religion. London, 1793.

<sup>9</sup> See Letter No. 62, note 4.

## No. 81.

PRIESTLEY TO REV. DR. ABERCROMBIE.<sup>1</sup>

CLAPTON, Aug. 21, 1793.

SIR: I think myself much obliged and honoured by your letters and the communication of the pamphlet you were so good as to send me; but having advanced all that I am able in my various publications, and long ceased to give any particular attention to the subject, I must be excused entering upon it again. It is now in other hands who are abundantly qualified to do justice to the arguments on both sides.

This will be delivered by one of my sons, all of whom I wish to settle in your country, and when that is accomplished I intend to join them.<sup>2</sup> The spirit of bigotry nearly bordering on that of persecution being encouraged by the Court is greatly increased in this country, which makes it, tho' not absolutely unsafe, yet unpleasant to live in it. I mean for those who have made themselves obnoxious for the freedom of their sentiments on religious or political subjects. The state of France increases this power of everything tending to innovation. Hoping that you will see our folly and profit by it, I am, Sir,

Yours sincerely,

J. PRIESTLEY.

JAS. ABERCROMBIE, Esq., Philadelphia.

By MR. J. PRIESTLEY.

[Endorsed]: This letter from Dr. Priestley to Dr. Abercrombie was given to me by the latter in 1831, but I promised his son it should be given to him at my death, on his demanding it.

ROBERT S. MINOR. [?]

<sup>1</sup> See Introduction.

<sup>2</sup> Four days after the date of this letter Priestley wrote to Mr. J. Gough at Savannah, in a similar strain, saying: "I send this by my sons, who are going to find a settlement in your country, all I have (three), and then I shall expect to follow soon. I cannot give you an idea of the violence with which every friend to liberty is persecuted in this country." (Rutt, II., 208.)

## No. 82.

PRIESTLEY TO DR. WITHERING.

CLAPTON, Oct. 22, 1793.

DEAR SIR: I was happy in hearing that you returned so much better from Lisbon,<sup>1</sup> tho' I am concerned to find that you think it necessary to go on the same account once more, but I hope it will be the means of finally establishing your health. I regret that, whether you return or not, I am in a manner cut off from my most agreeable connection with you and the other members of the Lunar Society. Here I hardly see any philosophical persons, except now and then Dr. Crawford. As to the *Royal Society*, I see myself regarded in so unfavorable a light by the most considerable members of it that I never go near them.

Andrews [?] whom I think you saw at Birmingham, was rejected because he was understood to be a *democrat* in politics. John Hunter<sup>2</sup> quietly canvassed against him; and gave Dr. Crawford that and no other reason for it.

I want your society the more, as I have now almost replaced my apparatus, and begun to be as busy in my laboratory as usual, tho' I fear I must break up once more to remove to America, whither all my sons are gone already. In the course of a few weeks (for that time will be necessary) I hope to have completed some experiments I am making on the relation of *water* to *air*, and, if anything of importance results from them, you shall be informed; tho' if you had been at

<sup>1</sup> See Letter No. 80, note 2.

<sup>2</sup> John Hunter, F.R.S. There being two persons of this name, both F.R.S., it is not certain to which Priestley refers. One, a surgeon, was noted for his anatomical studies, especially his papers on the *gymnotus electricus*, and on the heat produced by animals and vegetables. (Phil. Trans. 1773 to 1778.) The other was a doctor of medicine, and published "On the heat of wells and springs in the island of Jamaica," etc. (Phil. Trans. 1778.) The first-named John Hunter died Oct. 16, 1793, a few days before this letter was written, and the second John Hunter died in 1809, so the latter is the person alluded to in all probability.

Birmingham, our communication would have been easier, as I shall send my papers to the Lunar Society. In the mean time Mr. Galton will be able to give you some account of what I am about. In three different processes air *seems* to be producible from pure water, by means of heat, without limits, and the air so produced is better than common air. Since Mr. Galton was here, I have observed that the steam made to pass thro' a red-hot *silver tube* makes no difference whatever in the quantity or quality of the air. Also, in these circumstances I can, as he will explain to you, produce the usual quantity of air, or no air at all at pleasure. If the tube be of *copper*, the air is of a worse quality.

I am glad to hear there is so great a demand for your excellent work on botany. Can Mr. Jumary [?] out of the *waste*, as the printers call it, make up a P. [perfect?] volume, to complete my set [torn] imperfect in the notes? As you do not [neg]lect theological reading, I shall send you in a parcel to Mr. Watt a copy of my *an[swer]* to *Evanson*,<sup>3</sup> on the authenticity of the books of the New Testament.

I am much struck with your acc[ount] of the glass made at Lisbon. Can you give any reason for its peculiar property? I shall be glad to see your analysis of the mineral water<sup>4</sup> you mention. With every good wish to yourself and Mrs. Withering from myself and Mrs. Priestley,

I am, Dear Sir, yours sincerely,

J. PRIESTLEY.

DR. WITHERING, at Mrs. Martha Russell's, Falmouth.

<sup>3</sup> His "Dissonance of the Four generally received Evangelists, and the evidence of their respective Authenticity examined," 1792.

<sup>4</sup> The analysis of the medicinal spring at Caldas da Rainha, near Lisbon, was made by Dr. Withering in April, 1793.—"Miscell. Tracts," II. p. 397.

## No. 83.

PRIESTLEY TO DR. BENJ. RUSH.

NORTHUMBERLAND,<sup>1</sup> Sep. 14, 1794.

DEAR SIR: The Professorship of Chemistry in your College<sup>2</sup> has, I own, some attractions for me, and one of the

<sup>1</sup> Dr. Priestley's three sons emigrated to America in August, 1793, and receiving from them favorable reports, he himself, with his wife, joined them in April, 1794. He landed in New York June 4th, 1794; for a very interesting account of the voyage see Mrs. Priestley's letter to Rev. Mr. Belsham, in Rutt's Life, II., p. 235.\* In New York, as well as in Philadelphia, to which city he soon proceeded, Priestley received honorable attentions from public bodies, political and philosophical societies, and from individuals. (Rutt, II., pp. 241-262.) Priestley and his family settled in Northumberland, on the banks of the Susquehanna, and there occupied himself with writing theological essays and in pursuing his chemical researches. There he discovered carbon-monoxide, an inflammable gas which had hitherto been confounded with hydrogen. There he died in 1804, as announced in Letter No. 97.

<sup>2</sup> On the same day that Priestley wrote this letter to Dr. Rush, he wrote another to his friend Rev. T. Lindsey, in which he says: "The Professor of Chemistry in the College of Philadelphia is supposed to be on his death-bed. In case of a vacancy Dr. Rush thinks I shall be invited to succeed him." And on November 12th he wrote to the same: "I have just received an invitation to the Professorship of Chemistry at Philadelphia, and for some time was determined to accept of it, chiefly on account of the opportunity it would give me of forming an Unitarian congregation in that city; but when I considered that I must then pass four months of every year from home, my heart failed me, and I declined it. If my books and apparatus had been at Philadelphia I might have acted differently."

The chair of chemistry in the University of Pennsylvania was occupied at this time by Dr. James Hutchinson, who had succeeded Dr. Benjamin Rush. Dr. Hutchinson had studied in London under Dr. John Fothergill, and attained a proficiency in chemistry which was recognized by the Trustees of the College in the award of a gold medal. He died in 1794, and after Dr. Priestley had declined the chair it was again filled by the election of Dr. James Woodhouse, who expounded the antiphlogistic doctrines until his death in 1809.

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\* And for particulars of his arrival in New York see Henry Wansey's "Excursion to the United States of North America in the Summer of 1794." Salisbury, 1798 (2d ed.), 12mo.



principal is the opportunity it would give me of having the advantage of your society, the loss of which [I o-] ften speak of with regret. I have not in this country met with any person whose mind seems to be so congenial to my own. But I foresee several difficulties, and some of them, I fear, insuperable. 1. For the first year I could only give such a *general course* as I did at Hackney, the *Heads*<sup>3</sup> of which you may have seen. I have not a copy here; but Mr. Vaughan<sup>4</sup> can show you one, and as soon as a package arrives from New York I can present you with one. These would by no means supply so many lectures as your course would require. Again my apparatus is so packed up, and ready to be conveyed hither, that I could not make any use of it at present, and I fear yours would not sufficiently correspond to my course. 2. Being in *winter*, it would hardly be in my power to prepare the necessary experiments in the intervals of the lectures, even if I had an assistant. 3. My books too are so packed up, that I could not get at them for the composition of more lectures. Against another year I could be better prepared. In the mean time, could these defects be excused? for they cannot be wholly remedied.

Before I left England some fr [iends]  
had a scheme<sup>5</sup> of founding a Colleg [-e]

<sup>3</sup> See Letter No. 80, note 6.

<sup>4</sup> Mr. John Vaughan of Philadelphia. See Introduction.

<sup>5</sup> Of this scheme for a college at Northumberland, Mr. Joseph Priestley, in the continuation of his father's *Memoirs*, writes: "Soon after his settlement at Northumberland many persons with a view that his qualifications as an instructor of youth should not be wholly lost to the country, concurred in a plan for the establishment of a college at Northumberland. Many of the principal landholders, partly from the above and partly from motives of interest, contributed largely both in money and land, and there was a fair prospect, from the liberal principles upon which it was founded, that it would have been of very great advantage to the country. My father was requested to draw up a plan of the course of study he would recommend, as well as the rules for the internal management of the institution, and he was appointed president. He, however, declined receiving any emolument, and proposed giving such lectures as he was best qualified for, *gratis*, in the same manner as he had done at

I should settle on the idea tha [-t]  
 be in a part of the Country  
 not provided with any. Would th  
 give any assistance or wou [ld] [Torn]  
 to it? This seems to be a promis [-ing]  
 situation, and my library and Appa  
 ratus, might be of great use to it  
 leading men be consulted about it  
 This I should prefer to anything in  
 could be employed. But this, I fear, i [-s an un-(?)]  
 certain, as well as a distant, object.

I like this place much, but its [distance]  
 from Philadelphia, and want of an easy comm [-u]  
 nication with it, are great objections to it. The latter may in  
 time be removed.

With every good wish from my family to  
 [Torn] I am, Dear Sir,  
 Yours Sincerely,  
 J. PRIESTLEY.

I be comfortably boarded in a private family  
 [Torn] the College business would require.  
 Dr. RUSH, Philadelphia.

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No. 84.

PRIESTLEY TO DR. RUSH.

NORTHUMBERLAND, Oct. 28, 1794.

DEAR SIR: Your kind intention with respect to fixing me  
 in Philadelphia not taking place, I have now no other thought

Hackney, and he meant to have given to the institution the use of his  
 library and apparatus until the students could have been furnished with  
 them by means of the funds of the college. In consequence of the failure  
 of some of the principal contributors the scheme fell through at that time,  
 and little more was done during my father's lifetime, than to raise the  
 shell of a convenient building." (Memoirs, i. 169.)

than of settling in this place. I have therefore purchased ground on which to build a house, and to this I have destined a thousand pounds sterling.<sup>1</sup> A less house would have served for my family, but I must have room for my library and apparatus. I find, however, that there will be great difficulty in getting carpenters. Here none are to be had, and Mr. Jones, who is a carpenter here, and who superintends the whole, advises me to write to some friend in Philadelphia, to endeavour to engage hands there. We want at least *three* good workmen, but we could employ six or ten all the winter, or from this time. I thought it possible that as persons of all descriptions are now coming from England, some might be induced to settle here, where they will be sure to find full employment, and may live at a moderate expence; and you may have some friend who would take the trouble to look out for such hands as the ships arrive.

Mr. Jones says if any master carpenter would bring three or four hands, and undertake the building along with him, he should have no objection to it, or he would give him the place, and let him erect the whole himself.

As Mr. Vaughan<sup>2</sup> is from home, I do not know who to apply to in this emergency besides yourself, and as you must have acquaintance with persons of all classes, I hope the trouble to you will not be very great. The sooner I know whether any hands can be procured, and on what terms, the better, as I have not much time to lose.

I had a package of books, consisting chiefly of my own publications, copies of several of which I desired Mr. Thompson (who assists Mr. Dobson<sup>3</sup> in the printing business) to present you with in my name. I hope he has done it, tho' I have not heard from him on the subject. With this I beg

<sup>1</sup> Priestley bought 300 acres of land at 30 shillings an acre, besides a house-lot, on the river bank, of eleven acres, for which he paid one hundred pounds.

<sup>2</sup> Mr. John Vaughan, of Philadelphia; see Introduction.

<sup>3</sup> Mr. Dobson was a Philadelphia publisher.

your acceptance of a pamphlet<sup>4</sup> I have just printed here. The paper is wretched, but at the time no other could be had.

I hope that the scheme of a *college* in this town will not be given up. It appears to me to be a very convenient situation for one, and I should hope that I might be of some use to it. Would the State give any encouragement to it, and what would be the best method of applying for it? Some think that *Mr. Swanwick* should be desired to undertake it. I do not know him, but you must, and I shall not take any step in this business without your concurrence.

I shall hope to have the pleasure of seeing you in the Spring, and in the mean time, I am,

Dear Sir, yours sincerely,

J. PRIESTLEY.

P. S.—As Mr. Wharton intends to build here, as well as myself, he would perhaps assist in procuring carpenters to be sent hither. They will have the same price for their work as with you, and may live much cheaper.

DOCTOR RUSH, Philadelphia.

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No. 85.

PRIESTLEY TO DR. BENJ. RUSH.

NORTHUMBERLAND, Nov. 3, 1794.

DEAR SIR: I thank you for your kind hint respecting the professorship of chemistry; but you will excuse me if I feel a reluctance to comply with it. I cannot appear as a *candidate*; but if the place was offered to me, I would do my best to discharge the duties of it. The first year, indeed, I should lie under great disadvantage, but so must any other person suddenly called to a new employment.

<sup>4</sup> “A Continuation of the Letters to the Philosophers and Politicians of France on the subject of Religion, and of the Letters to a Philosophical Unbeliever, in answer to Mr. Paine’s *Age of Reason*.” Northumberland Town, 1794.

I am not, however, at all anxious about this business, hoping we shall succeed in establishing a College in this place; and it will be more convenient to me [to] be employed here, than in Philadelphia; tho' a call to spend some time, every year, in that place would not, I acknowledge, be ungrateful to me.

Besides the letter you mention, I took the liberty to write you another, about a house I propose to build here, and other matters.

With gratitude and esteem, I am,

Dear Sir, yours sincerely,

J. PRIESTLEY.

DOCTOR RUSH, Philadelphia.

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No. 86.

PRIESTLEY TO DR. BENJ. RUSH.

NORTHUMBERLAND, Nov. 11, 1794.

DEAR SIR: I hope you will excuse my weakness (for such you will consider it), when, after giving you reason to expect that I would accept the professorship of Chemistry, if it was offered to me, I now inform you that I must decline it.

On the receipt of your obliging letter, I was determined to accept of it, and in my own mind had made every arrangement for that purpose. But when I began to consider the difficulty and irksomeness of a journey to Philadelphia at this time of the year, and especially the obligation I should be under of spending four months of every year from home, my wife in the house by herself, my heart failed me.

This, in fact, is my only objection, but it is an insuperable one. I am truly sensible of the honour that is done me by the invitation, and beg that you would express it for me to all the persons concerned. Nothing could have been so pleasing to me as the employment, and I should have been happy in your society, and that of other friends in the Capital, and, what I have much at heart, I should have had an opportunity of

forming an Unitarian congregation in Philadelphia. But the considerations as mentioned, and that of my time of life, lead me to continue where I am, waiting for the opportunity of being of use to the College which I hope will be established here.

Had this proposal been made to me before the removal of my library and apparatus hither, the case would have been different; but this being now done, at a great risk and expence, I am, at all events, fixed for the remainder of my life.

If I had come, Mr. Henry would have assisted me in collecting materials, and making the preparations for the necessary experiments. As he is well qualified for the office, if you be not better provided, what should you think of *him*? At least, I think the students might, with advantage, attend his lectures, till the vacant professorship be filled. This I observe *in confidence*, wishing the hint to go no further, if you disapprove of it.

With the greatest gratitude and respect, I am,

Dear Sir, yours sincerely,

J. PRIESTLEY.

DOCTOR RUSH, Philadelphia.

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No. 87.

PRIESTLEY TO DR. BENJ. RUSH.

NORTH'D, May 22, 1795.

DEAR SIR: The day after I received your favour I, having just then got my apparatus ready, made trial of the air of Northumberland by the test of nitrous air, but found it not sensibly different from that of England. Your conjecture, however, was very natural.

I cannot make many experiments to much advantage till I get into the house I am about to build. At present I have both my library and apparatus in one room in my son's house.

I desired Mr. Vaughan to call upon you, and consult with you about engaging some place in which I can preach when I pay you a visit, as I wish to do, in Philadelphia. If I appear there at all, it shall be in my proper character, of a *Christian minister*, and I will not be reduced to a state of

disgraceful silence by the bigotry and jealousy of your preachers. The Universalists said they should have no objection to my preaching in their place; but it was not then built. It may be now.

We are much obliged to you for the pains you have taken about our *Academy*. As the situation is not unfavorable, I hope it will succeed.

You will probably have heard of the death of Mr. Haynes. It will make some change in our situation, but whether for the better or the worse is at present uncertain.

I have received several letters, which give me an excellent character of Mr. Millar, son of Professor Millar<sup>1</sup> of Glasgow. He is come to America, and wishes to be employed in some College. Our scheme is hardly ripe enough for such a person.

I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

DOCTOR RUSH, Philadelphia.

By favour of J. Young.<sup>2</sup>

No. 88.

PRIESTLEY TO JOHN VAUGHAN.

NORTH'D, Oct. 17, 1795.

DEAR SIR: I begin to [be] alarmed when I look at the draughts I have made upon you this month, but I hope I shall not draw for so much for several months to come. They are as follows:—

William Spring	200 dollars.
John Boyd	280
Aaron Levi	220
James Hepburn	300
John Conden	150

<sup>1</sup> John Millar (b. 1735, d. 1801), the eminent Scotch jurist and professor of civil law in Glasgow, author of historical works, and an attractive lecturer on his specialty.

<sup>2</sup> See Letter No. 88, note 3.

The last is to supply a loss of Henry's<sup>1</sup> when he was last in Philadelphia. That to Aaron Levi is drawn as for my son Joseph, but you must put it to my account, not his. I shall have a farther payment to make to Mr. Boyd; and another to Mr. Martin for purchases, and then, as I do not build till the next Spring, I have not to trouble you for more than for current expenses.

I am exceedingly happy in the prospect of Mr. Russell<sup>2</sup> fixing with us. In time I hope we may make the place not unworthy a visit from Mr. Vaughan. In the meantime, I hope to pay you a visit after Christmas. I shall write a good many letters for England, to go by Dr. Young,<sup>3</sup> who will sail soon.

Yours sincerely,

J. PRIESTLEY.

JOHN VAUGHAN, Esq., No. 111 S. Front St., Philadelphia.

By favor of Mr. Hepburn.

[Endorsed :] Doct. Priestley, North<sup>d</sup>., Oct. 17, 1795, Rec'd 26th, 1795.

<sup>1</sup> Henry Priestley died just two months after the date of this letter (Dec. 11, 1795).

<sup>2</sup> Mr. William Russell, Priestley's staunch friend and fellow-sufferer in the riots of 1791. He set out from England with his family, two daughters and a son, in August, 1794. He did not, however, arrive in America until September, 1795, having been taken a prisoner soon after his sailing from Falmouth, by a French squadron, and detained in Brest Harbour, notwithstanding the immediate intercession of the American Minister. (Rutt, II., 279.) Dr. Priestley was disappointed that Mr. Russell did not join him in Pennsylvania, but he preferred New England, and settled in Middletown, Conn. Mr. Russell returned to France in 1801. (Rutt, II., 327.) (See Letter No. 7, note 4.)

<sup>3</sup> Dr. Young was a physician of Northumberland, who, leaving his practice, started for a tour in Europe. Priestley writing by him to the Rev. Th. Lindsey, says: "A more friendly man I have hardly ever known, and I hope that, though we lose him for the present, we shall get him again, and that he will build and settle in this town." (Rutt, II., 322.)



## No. 89.

PRIESTLEY TO DR. WITHERING.

NORTHUMBERLAND COUNTY, Oct. 27, 1795.

DEAR SIR: Your letter was peculiarly welcome to me, as from the accounts I had received of the state of your health, I was apprehensive that our intercourse on this side the grave was at an end. I do, indeed, rejoice in hearing, and especially from yourself, so much better an account than I expected, and flatter myself that tho' you may not get hardy, you may have tolerable enjoyment of life for many years to come. I am also happy to find that you are determined not to be idle, and that we may expect so much an improved edition of your Botanical work. Mr. Galton, in a letter I have received from him since I had yours, mentions several of the improvements which please me much, tho' I do not pretend to be a judge of those matters. Were I a young man, I should certainly, especially in this new world, apply to Botany, and Natural History in general, but it is too late in life for me to engage in new pursuits. It will be well if I should be able to close some of the old ones, and in this I am now assiduous, and happily have more leisure for these than ever I had, tho' I have not the same advantage that I had in England. More than ever do I now regret the loss of the *Lunar Society*, where I spent so many happy hours, and for which I found no substitute even in London. Here I am quite insulated, and I promise myself, when my house and laboratory shall be erected to devote as much time to philosophical pursuits as ever I have done. Hitherto it has not been in my power to do much, as I have only one room in my son's house for my library and apparatus too. But I have done almost all that I can in the generation of air from water, and shall soon draw up a *sequel* to my pamphlet on that subject for the society at Philadelphia. I still find no end to the production of air from the same water, tho' I can now torture it in more ways than I thought of before. That the air I get is not imbibed in the course of the process is demonstrable from its being at the last wholly

phlogisticated air. The first that is extracted is always much purer than common air, and I presumed that it would continue to be so, tho' operating on a small scale, I could not ascertain it. I now do it with the greatest certainty. It is possible, however, that the air yielded by water may be that which it originally got from the atmosphere, retaining with the greatest obstinacy that which it is least apt to imbibe. I had many experiments, and some of them rather curious, on water deprived of air imbibing such as I present to it, which I do with great ease; but the particulars are too many for a letter.

I am now in a course of experiments by which I think I shall prove pretty decisively that what I have called the *phlogistication of air* is really so, and not the mere absorption of the pure part of it, as the French chymists suppose. In many of the cases there is something emitted from the substance, as well as something imbibed by it, and this something which we have called *phlogiston* uniting with the pure part of the air, makes phlogisticated air, so that originally it contains more pure air than they suppose. I have to ascertain how much it really is, and how much is the produce of phlogistication. In other processes I think I make phlogisticated air by the unison of dephlogisticated and inflammable air; but the processes are not yet completed.<sup>1</sup> Having more opportunity for reading and writing than for anything else, I am now chiefly employed in the continuation of my *History of the Christian Church*, tasking myself, as I presume you do, so much every day. By this means I reckon that I shall complete the whole in two years, and more than half of one is expired.<sup>2</sup>

<sup>1</sup> The results of these experiments were embodied in: "Experiments and Observations relating to the Analysis of Atmospherical Air; also further Experiments relating to the Generation of Air from Water." Read before the American Philosophical Society, February 5th and 19th, 1796, and printed in their Transactions. These papers were reprinted, with some additions, in London, same year. Cf. note 2 of Letter No. 26 for Priestley's earlier experiments in this direction.

<sup>2</sup> Priestley had published the "General History of the Christian Church to the Fall of the Western Empire," in 1790. The second edition to which he alludes was not completed until 1802-03, in four volumes.

Soon, however, I expect to be employed in the instruction of youth, as a *college* is to be established in this place, and I am appointed the principal.<sup>3</sup> The next spring we begin to build; but our funds will be small. I wish we had a proper person for teaching *Natural History*, including Botany. Almost everything else I can, *pro tempore*, in some measure, teach myself. When our common hall is erected, I shall also make use of it as a chapel, for such is the bigotry of the people in this part of the country, that tho' in every other respect my reception has been very flattering, their pulpits are all shut to me. At Philadelphia, I am assured, I should raise a congregation of unitarian Christians, but on several accounts I could not live there. It is expensive, and disagreeable in the extreme. I was invited to the professorship of chemistry there, but I must have lived in the town, and more would have been expected of me than I could have performed, without more labour than, at my time of life, and interrupted as I should have been, than I could well support. I intend, however, to spend a month or six weeks there every winter.

I am glad to hear of the fair trial that will be made of Mr. Beddoes'<sup>4</sup> theory at Birmingham. I want Mr. Watt's apparatus.<sup>5</sup> I could use it for various purposes. Perhaps he will have the goodness to send it me, and might not be pleased if I proposed to pay for it, as I gladly would do. I must get everything of much value from England. I am much pleased with your favourable account of Portugal. I had not heard

<sup>3</sup> See Letter No. 83, note 5.

<sup>4</sup> Dr. Thomas Beddoes had founded at Bristol a Pneumatic Institute for the medical administration of artificial airs. He published, between 1794 and 1796, several papers on the "Medicinal use of factitious airs and on the manner of obtaining them in large quantities." In these researches he was assisted by James Watt, and afterwards by Humphry Davy, who made his celebrated discovery of the properties of "laughing gas" in the Institution at Bristol.

<sup>5</sup> This is undoubtedly Watt's Pneumatic Apparatus, described in Beddoes's work named in the preceding note.

of my election into their society. Take care of your health, and write to me often.

Yours sincerely,

J. PRIESTLEY.

P. S.—Our best respects to Mrs. Withering.

DR. WITHERING, Birmingham, England.

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No. 90.

PRIESTLEY TO WM. VAUGHAN.<sup>1</sup>

NORTHUMBERLAND, Nov. 1, 1796.

DEAR SIR: I lately concluded a letter begun by my wife to your mother, the last that she attempted to write, for she died about ten days after.<sup>2</sup> The shock was the more severely felt, for it was unexpected till the day on which she died, tho' we were a little alarmed at times before. But the preceding night, and that very morning, we thought her considerably better. If my son had not been so near me, so that I can live with him, I should not have known what to do; for you know I was, as I have often said, only a lodger in her house. I had no care of anything, but employed myself wholly in my own pursuits. She was much attached to this place, and had it not been for that I should certainly have fixed somewhere nearer to Philadelphia. But as she had suffered much on my account, I thought it right to sacrifice something to her, thinking, at the same time, that I could make this situation answer all my own views, as I hope I can. It is now impossible for me to remove, but I shall spend more time in Phila-

<sup>1</sup> Just before sailing for New York, Dr. Priestley was a guest of Mr. William Vaughan.

<sup>2</sup> Mrs. Mary Priestley died September 17th, 1796. Her unfinished letter to Mrs. Vaughan is mentioned by Priestley in his correspondence with Lindsey and with Belsham. (Rutt, II., 357 and 360.) Mrs. Priestley's "constancy and perseverance" in supporting her husband "under all his trials and sufferings" have been recorded by an affectionate son in the continuation of his father's Memoirs. Dr. and Mrs. Priestley had suffered the loss of their youngest son a few months before.

delphia than I should otherwise have done, if it can be made tolerably convenient for me.

I wonder we hear nothing of your brother. I wish we had him, and indeed all our friends, farther from the trouble in which Europe is involved, and which I fear will extend much farther.<sup>3</sup> Here we are happily at peace, and I hope likely to continue so, and the country is in all respects in a more flourishing state than any that was ever known or heard of. We are about to change our President,<sup>4</sup> but, tho' the contest will be a very warm one, it will be attended with no serious inconvenience. The moment it is decided by a majority of votes all will acquiesce. There is no danger of any insurrection or disturbance of any kind.

I fear I have made too free in drawing for money. But the expense attending the building of my house<sup>5</sup> has far exceeded my calculation. However, I want to see your account, and then I can take my measure better for the future.

I am glad to hear that Mr. Wilkinson's affair is at last settled, tho' I fear not to the satisfaction of both parties, which indeed were hardly possible. It was a source of much concern to my wife, who always held with the older brother.

Mr. Russell<sup>6</sup> is now in this house, on his way to some lands that he has north of this place, but he has taken a house at Middletown, in Connecticut, so that I do not expect to see much more of him. But I do not wish for much society.

With every good wish to all the family I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

P. S. All here join in their respects.

WILLIAM VAUGHAN, Esq., Mincing Lane, London.

<sup>3</sup> This probably refers to the wars in which Bonaparte was engaged. In 1796 he was in Italy.

<sup>4</sup> Washington was succeeded by John Adams in 1797.

<sup>5</sup> Priestley's house on the bank of the Susquehanna, Northumberland, is still in fair condition.

<sup>6</sup> See Letter No. 7, note 4, and Letter No. 88.

## No. 91.

PRIESTLEY TO BENJ. VAUGHAN.

NORTHUMBERLAND, Ap. 19, 1798.

DEAR SIR: You are very kind in endeavoring to facilitate my journey to Kennebec, but at my age, which you seem to overlook, but the effects of which I feel, it is too formidable an undertaking. Crossing the Atlantic appears much less formidable. Besides, tho' I should consider your *residence* near me as a thing valuable, a *visit* would answer little purpose, and be a great interruption to my pursuits; and as the day draws towards a close with me, I have no time to lose. When I begin to be less capable of application, which will be at no great distance, I shall court idleness, and be thankful for amusement.

I cannot imagine what you mean by intimating that some *event* may take place here in which I may be of some use. Whatever it be, you certainly overrate my importance in fancying this. All that I can possibly do here is in *theology*, and that is over. The proposal for my *Church History*<sup>1</sup> gets me only seven subscribers in Philadelphia, and among them was not Mr. Adams, tho' he received in a flattering manner the dedication of a volume of my Discourses.<sup>2</sup> All that I can do here is to compose the works I mentioned, and prosecute my *experiments*,<sup>3</sup> for which I have, at least, the advantage of *leisure*, and print them when I can afford it myself. I have never completed my Expositions of the *Revelation*, and have made some progress in that of *Daniel*. This I could wish to have your perusal of; but I cannot venture to send the copy so far. I have also some curious facts in philosophy to men-

<sup>1</sup> "A General History of the Christian Church from the Fall of the Western Empire to the present time." Vols. i. and ii. were published in 1802, and iii. and iv. in 1803.

<sup>2</sup> Discourses relating to the Evidence of Revealed Religion, delivered in the Church of the Universalists in Philadelphia, and published at the request of many of the Hearers. Vol. i., 1796, vol. ii., 1797.

<sup>3</sup> Priestley discovered the gas carbon monoxide in the following year.

tion ; but that will answer no end before you have seen what I have already printed on those subjects in the country, and there is much uncertainty in sending anything to so great a distance. I sent copies of all my publications to your brother Charles. They make *ten* different articles, besides *two* printed in the Transactions of the Philosophical Society, and reprinted in a pamphlet in England. I have now, no doubt, of overturning the French new theory of chemistry.<sup>4</sup>

I have no thoughts of going to France before a *peace*, or of ever becoming a citizen of the United States. In my case, it could not answer any end whatever. I choose rather to live as a *stranger* in the country. Such is the state of things in France, that I now give up all expectations of making anything of my property there.

I wish *you* had been nearer the seat of government you might have been of some use in the present awkward state of things, tho' I know there is a great jealousy of the interference of foreigners, I keep out of the way of all Politics, and yet I meet with more, and more coarse abuse here, than in England, and in a newspaper most patronized by the governing people. But these things do not affect me much now. I had hoped, however, that, while I was quiet myself, I might have been quiet in this country ; to peace I have always been a friend. But the jealous friends of the revolution here are in general out of favour now, and the tories are courted and popular.

To kiln dry boards we dig a trench about two feet deep, the length of the boards and what breadth you please. We then support the board with the edges downwards, and so that when the fire is made under them, the smoke and heat may have access to every part of them. Two or three stages are placed one over another, and on the outside boards to keep off the rain. In ten days they will be as much dried as by exposure to the air two years. We commonly kiln dry ten thousand feet at a time. The fire wood must be such as is not apt to flame, lest the boards should take fire, which sometimes

<sup>4</sup> Priestley published numerous short articles in the years 1796-99 in the New York Medical Repository, and in the Trans. Am. Philos. Soc.

happens. The expense cannot be much. A house constructed with such boards I prefer to one of brick or stone.

I have the work you mention of Beausobre,<sup>5</sup> and have abridged it in my Church History but I never before heard of the Appendix. In revising my works I frequently want to have recourse to my authorities but if it be of much consequence to you I will send it. We have now a stage wagon to Philadelphia which goes once in about six weeks.<sup>6</sup>

Yours sincerely,

J. PRIESTLEY.

BENJAMIN VAUGHAN, Esq., at Charles Vaughan, Esq., Boston.

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No. 92.

PRIESTLEY TO DR. BENJ. RUSH.

NORTHUMBERLAND, Aug. 8, 1799.

DEAR SIR: I thank you for your very curious lectures on *Animal Life*, which I have read with very great satisfaction, as, indeed, I do everything of yours. I like all your medical tracts, because I think I understand them better than most things of the same kind. I shall read all your volumes with more attention than ever.

In return I shall have to present to you a work I have in the press, and which I call a *Comparison of the Institutions of Moses with those of the Hindoos and other antient nations*.<sup>1</sup> We have printed about two-thirds of it, and it will be a pretty large volume, 8vo. It includes, however, *Remarks on M. Dupuis' Origin of all Religions*, and an *Address to the Jews on the present state of things, and their interest in it*; and also, *Methodical arrangement of all the laws of Moses*. I am well

<sup>5</sup> Isaac de Beausobre, an eminent French Protestant theologian, born 1659, died 1738, author of several theological works of historical bearing.

<sup>6</sup> A distance of 132 miles.

<sup>1</sup> Published in 1799.



aware that I shall be a considerable loser by the work, but it is the only way in which I can be of any use in this country. My object was never gain in any of my publications, and if I can only bear the loss I shall look no further.

I wish I could give you as much satisfaction with respect to the *prophecies* as you do to me with respect to *Medicine and Physiology*. The present time is certainly a most interesting one, and the fall of at least one of the monarchies of Europe, and especially that of the pope, shows us where we are in the great chain of Events. I expect the downfall of all the states represented by the *ten toes* in the image of Nebuchadnezzar, and the *ten horns* of the 4th beast of Daniel before the present war be over. They were all to fall *together* and with *violence*. Egypt is, no doubt, to be raised from its late abject state about the same time, but whether by Buonaparte, or some other, we cannot presume to say. He may be only the *precursor* of their *great deliverer*. I think it more probable that the French nation will be the great instrument in the hand of God to effect these great things, as their leading men have no views of the kind; so that it will not be said hereafter that the prophecies have fulfilled themselves. I look for great things in the present generation. You are younger than I am, and will probably see them.

Having much leisure, and no disposition to idleness, I have been busy, and I think pretty successfully, in my *experiments*,<sup>2</sup> one object of which has been the overturning of the French system of chemistry, and at present having seen what Dr. Woodhouse<sup>3</sup> and others have advanced in support of it, I am pretty confident that it will fall. I have sent to the *Medical*

<sup>2</sup> On December 20, 1799, Priestley read to the Philosophical Society in Philadelphia a paper entitled: "Experiments on the change of place in different forms of air through several interposing substances," in which he recognizes distinctly, for the first time, the phenomena of gaseous diffusion. Cf. Letter No. 30.

<sup>3</sup> Dr. James Woodhouse, Professor of Chemistry in the Medical Department of the University of Pennsylvania from 1795 to his death in 1809. He was a frequent contributor to Mitchell's Medical Repository, and opposed Priestley's phlogistic views.

*Repository*<sup>4</sup> three articles<sup>5</sup> in answer to Dr. Woodhouse, and shall soon write out an account of some experiments of a different kind, which I have made in this place.

Were you at liberty to make an excursion as far as these *back woods* I shall be happy to see you, and so would many others.

I am, Dear Sir,

Yours sincerely,

J. PRIESTLEY.

DR. RUSH, Philadelphia.

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No. 93.

PRIESTLEY TO CITIZEN PERIGAUX.

PHILADELPHIA, April 12, 1801.

SIR: I take the opportunity of Mr. Henry's return to France (and to whom I transferred the bill that you authorized me to draw upon you) to request that you would inform me of the amount of the annual income from the whole of Mr. Wilkinson's donation, on the supposition of his sending you the necessary powers to complete the transfer, and also of the probable state of your funds in future.<sup>1</sup>

I am interested in your answer, as it is my wish to reside some time at least with you, if the property in France will

<sup>4</sup> The Medical Repository. Edited by Samuel L. Mitchill. New York, 1797-1826. Dr. Priestley was a frequent contributor to this journal from its establishment to his death. In the second volume (1798-99) he published no less than eight letters addressed to Dr. Mitchill, in defence of the theory of phlogiston. (Pp. 48, 163, 166, 263, 269, 383, and 388.)

<sup>5</sup> Dr. Priestley's Reply to his Antiphlogistic Opponents, *Med. Repos.*, iii. 116, 121, 124 (1800).

<sup>1</sup> This refers to the donation of £10,000 in French funds by Mr. Wilkinson. See Letter No. 64, note 2.

This apparently never yielded any income to Priestley, who planned in 1797 to go to France to attend to the matter. (Rutt, II., 375.) M. Perigaux was his banker in Paris.

afford me a decent subsistence. When I was obliged to leave England I came hither, because, at that time, I could not go to France, which I should have preferred on many accounts.<sup>2</sup> I now hope we shall soon have the great blessing of peace, when I may cross the Atlantic with safety.

When I wrote last I was just recovered from a dangerous illness, at present my health seems to be completely re-established.<sup>3</sup>

I am, Sir, Yours sincerely,

J. PRIESTLEY.

CITIZEN PERIGAU, Banker, Paris.<sup>4</sup>

### No. 94.

PRIESTLEY TO DR. BENJ. RUSH.

NORTHUMBERLAND, May 7, 1801.

DEAR SIR: I send you *two papers*,<sup>1</sup> one in the form of a letter addressed to yourself, which, *if you approve of*, you may send to the Medical Repository. I have most doubts about the paper on *Dreaming*, as you will see that I have nothing to propose but a fact or two, and nothing at all satisfactory by way of hypothesis to account for them. The most important part is what I borrow from you. However, I leave it to your disposal.

<sup>2</sup> See Letter No. 79, note 1.

<sup>3</sup> Priestley had been dangerously ill with "bilious fever and pleurisy," for which Dr. Rush bled him "profusely seven times." President Jefferson wrote him a kind and confidential letter at this time, asking him to complete his recovery by paying him (Jefferson) a visit. (Memoirs, Correspondence and Private Papers of Thomas Jefferson, 1830, III., 468.)

<sup>4</sup> This letter is endorsed apparently by the recipient: "Philadelphia, 12 avril, 1801. J. Priestley. R[egu] 10 July, 1802." It bears a postmark, "Hamburg."

<sup>1</sup> These were undoubtedly the following:—

"Some Thoughts concerning Dreams," published in *Med. Repos.*, v., 125; and—

Remarks on the Work entitled: "A Brief History of Epidemic and Pestilential Diseases" [by Noah Webster], published in the same volume, page 32.

With the other I am better satisfied, and if you correspond with Mr. Webster,<sup>2</sup> you may tell him how well satisfied I am with his work. But his philosophy is wild and absurd in the extreme. Pray is he a believer in revelation or not? I find several atheists catch at everything favourable to the doctrine of *equivocal generation*; but it must be reprobated by all who are not.

If there be anything not correct in what I have said of an *anatomical kind* I hope you will alter it. This part of my library is very scanty, and I have but an imperfect recollection of what I once knew of the subject. If anything occur to you in considering it, I wish you would add it as from yourself.

I frequently think with much pleasure and regret on the many happy hours I spent in your company, and wish we were not at so great distance. Such society would be the balm of life to me. But I must acquiesce in what a wise providence has appointed.

Yours sincerely,

J. PRIESTLEY.

DOCTOR RUSH, Philadelphia.

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No. 95.

PRIESTLEY TO DR. BENJ. RUSH.

NORTHUMBERLAND, Jany. 27, 1802.

DEAR SIR: I take the opportunity of my son's going to Philadelphia to thank you for the very acceptable present of the Copy of your *Lectures*. I have read them with more satisfaction than I can express. I do not think that such enlarged views ever [occurr-]ed to any professor of medicine in [—(torn)]. Tho' sublimely speculative, they are at [th-]e same time highly practical and useful. Every thing I see of

<sup>2</sup> Noah Webster, the distinguished lexicographer (1758-1843), was at this date engaged on his "Dictionary of the English Language."

yours makes me wish to see the practical and *popular treatise on medicine* that you told me you had in hand. I hope we shall not wait for it long.

I suffered a good deal from the ague in our late unhealthy season, and also from indigestion ; but I thank God I am now recruiting, and hope to be as well as usual in a short time ; tho' I do not expect to recover the flesh and the strength that I had before my illness in Philadelphia, when I was so much indebted to your kind attention.

With the greatest gratitude and respect, I am,

Dear Sir, yours sincerely,

J. PRIESTLEY.

DOCTOR RUSH, Philadelphia.

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No. 96.

PRIESTLEY TO DR. BENJ. RUSH.

NORTHUMBERLAND, Aug. 5, 1802.

DEAR SIR : Did there appear to me the least propriety, or probability of effect, in the application you propose, I would do it for you sooner than for the nearest relation of my own. But what can I say of your brother, as a man, or a lawyer, that is not much better known to the governor already ? And as he is no stranger to my intimacy with you, he would, tho' I should not mention your name, conclude it was only you that [—(torn)] to him thro' me. Your brother's character and merits as a lawyer, which I believe nobody questions, cannot be unknown to the governor, who is himself a lawyer, and I hope it will not pass unnoticed by him. However, I understand that no alteration will be made in the judiciary system this session.

Your letter came when I was in bed, confined by an ague, which I had every day for a whole week, but it has now left me.

I wish much to see your *family physician*. Tho' I was never robust, I hardly knew what sickness was before my

seizure in Philadelphia, but the old building has since that had so many shocks, that I am apprehensive it will ere long give way. But I have abundant reason to be satisfied, and shall retire from life *conviva satur*. Admonished, however, by present appearances that what I do I must *do quickly*, I have begun to print my *Church History*,<sup>1</sup> to be followed by my *Notes on the Scriptures*.<sup>2</sup>

I have sent you a small pamphlet<sup>3</sup> [—(torn)] have just printed, on a subject that will not probably interest you much, tho' every thing relating to Christianity interests its friends more or less.

I am, Dear Sir, yours sincerely,

J. PRIESTLEY.

DOCTOR RUSH, Philadelphia.

## A PRINTED CIRCULAR.

PHILADELPHIA, March 2d, 1803.

SIR: You are hereby invited to join the other members of the American Philosophical Society, in giving a testimony of respect, to their venerable associate Dr. Joseph Priestley, who dines with them on Saturday next at Francis' Hotel—Dinner on table at 3 o'clock.

C. WISTAR,	} Committee.
J. WILLIAMS,	
J. R. SMITH,	
T. T. HEWSON,	
J. VAUGHAN,	

An answer will be called for to-morrow morning.

DR. RUSH.

<sup>1</sup> A General History of the Christian Church from the Fall of the Western Empire to the present time. Vols. I. and II., 1802; III. and IV., 1803.

<sup>2</sup> Priestley did not live to carry out this project; but the work appeared posthumously under the title: Notes on all the Books of Scripture for the use of the Pulpit and Private Families.

<sup>3</sup> Probably: "A Letter to an Anti-pedo Baptist," published in 1802.

## No. 97.

THOS. COOPER TO DR. BENJ. RUSH.

NORTHUMBERLAND, Feb. 6, 1804.

DEAR SIR: Mr. Joseph Priestley is not at present in spirits to write to his friends, and it falls to my lot therefore to acquaint you that Dr. Priestley died this morning about 11 o'clock, without the slightest degree of apparent pain. He had for some time previous, foreseen his dissolution, but he kept up to the last his habitual composure, cheerfulness and kindness. He w'd have been 71 the 24th of next month. For about a fortnight there were symptoms of dropsy owing to general debility: about two days before his death, these symptoms disappeared, and a troublesome cough came on perhaps from a translation to the chest.

Yesterday he had strength enough to look over a revise of the Annotations he was publishing on the Old and New Testament, and this morning he dictated in good language some notices which he wished his son Mr. Priestley to add to his unpublished works. I am sure you will sincerely regret the decease of a man so highly eminent and useful in the literary and philosophical world, and so much personally your friend.

Believe me with much respect

Sir, Your obed't servant,

THOS. COOPER.

DR. RUSH, Philadelphia.

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The following memorandum is in the collection of Mr. Conyers Button, of Germantown, Philadelphia, to whom we are indebted for the privilege of its publication.

## COPY OF LETTER OR MEMORANDUM.

*No date, no address, no signature.*<sup>1</sup>

Dr. Priestley, having written the *History and Present State of Electricity*, would willingly undertake to write the history of all the other branches of *experimental philosophy* upon the same extensive plan. He apprehends that a work of this kind exhibiting a view of all that has been done already, would, on several accounts greatly facilitate future discoveries in science; but he has hitherto been discouraged from undertaking it by the expenses in which it would necessarily involve him, and which he is not able to supply; particularly in procuring the books to which he cannot have access in his present situation. In order to execute this work with advantage, he will also be under an immediate necessity of considerably enlarging his *philosophical apparatus*, both to ascertain many disputed facts, and to pursue the hints for farther discoveries, which the consideration of those that have been made by others will unavoidably suggest. His history of electricity was very expensive to him on this account, but he thinks himself well repaid by the many *original experiments* he was thereby enabled to make, most of which are now before the public.

Dr. Priestley would think himself greatly honored, if his Grace the Duke of Northumberland should think this work worthy of his patronage.<sup>2</sup>

<sup>1</sup> Written in a clear hand on paper 12 $\frac{1}{2}$  inches by 7 $\frac{3}{4}$  inches.

<sup>2</sup> Priestley's "History of Electricity" was published in 1767; it is dedicated to James, Earl of Morton, President of the Royal Society. The Preface is dated Warrington, March, 1767; the second edition is dated Leeds, January, 1769. Priestley published his "History and Present State of Discoveries relating to Vision, Light, and Colours," in 1772 (2 vols. 4to.).

In his autobiography, Dr. Priestley writes: "Having succeeded so well in the History of Electricity, I was induced to undertake the history of all the branches of experimental philosophy; and at Leeds I gave out proposals for that purpose, and published the: 'History of Discoveries relating to Vision, Light, and Colours.'" (Rutt's edition, I., 77-78.)

The preceding memorandum is apparently the draft of the "proposals" here referred to; this would fix the date of the writing between the years 1768 and 1771, during which time he resided at Leeds.





SYNOPSIS  
OF  
CORRESPONDENCE OF DR. PRIESTLEY;

CONSISTING CHIEFLY OF

LETTERS FROM HIM TO HIS BROTHER-IN-LAW, MR. WILKINSON,  
FROM THE YEAR 1790—1802.

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DEPOSITED BY JOHN F. MARSH, JANUARY, 1850, IN THE WARRINGTON MUSEUM AND  
LIBRARY BY PERMISSION OF MR. WILKINSON'S FAMILY.

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1. 26 March, 1789. Mr. Joseph Priestley, son of Dr. Priestley, to Mr. Wilkinson, his maternal uncle and employer, asking his sanction to the writer's marriage with Miss Ryland.
2. 2 Sept., 1790. Dr. Priestley to his brother-in-law, Mr. Wilkinson, on Mr. Joseph Priestley's marriage and prospects, and asking Mr. Wilkinson to take Dr. Priestley's second son, William, into his service—alludes to the writer's philosophical works. Also sketch of Mr. Wilkinson's answer.
3. 3 October, 1790. Mr. Joseph P. to Mr. W., declining to settle at Bersham.
4. 11 Oct., 1790. Dr. P. to Mr. W. on the same subject and the prospects of his other sons.
5. 18 Oct., 1790. Mr. Joseph P. to Mr. W. declining his offer and proposing to leave his service.
6. 26 Oct., 1790. Mr. W.'s answer.
7. 3 Nov., 1790. Dr. P. to Mr. W. on Mr. Joseph P.'s connection with the latter and the altered prospects of the writer's family. Alludes to a sermon he had published.
8. 20 Jan., 1791. Dr. P. to Mr. W. on the same subject. Speaks of his Letters to Mr. Burke and mentions the number of copies in the three editions.

9. 18 Feby., 1791. Dr. P. to Mr. W. on same subject, and on pecuniary affairs.
10. 25 Feby., 1791. Dr. P. to Mr. W.'s secretary.
11. 20 Aug., 1791. An interesting letter on the subject of the Birmingham Riots. Mentions that he is engaged on an Appeal to the Public on the subject.
12. 5 Sept., 1791. Mr. Galton to Dr. P. on affairs at Birmingham and Dr. P.'s contemplated visit there.
13. 8 Sept., 1791. Dr. P. to Mr. W. arranging to visit him at Castlehead. Comments on affairs at Birmingham, and states that his friends at Manchester are afraid to receive him.
14. No date (Sept., 1791). Dr. P. to Mr. W. with change of plans. Determined to reside at Hackney. Thoughts of emigrating. Investments in French and American funds.
15. 4 Oct., 1791. Dr. P. to Mr. W. Birmingham Riots. Prospects of England and France. French and American funds. Offer of inhabitants at Toulouse to place a vacant monastery at Dr. P.'s disposal. Dissenters at Hackney.
16. 6 Oct., 1791. Mr. W. to Dr. P. advises settling in France. Investment in French funds.
17. 23 Nov., 1791. Dr. P. to Mr. W. asking advice on the "Appeal to the Public." Condition of his Library, etc. His pursuits. Residence at Clapton. Congregation at Birmingham dare not receive him.
18. 18. Feby., 1793. Dr. P. to Mr. W. Politics and prospects of war. Dangers of his own position and thoughts of emigrating. His son William settled in France.
19. 19 March, 1793. Dr. P. to Mr. W. Mentions his letter in reply to the observations of Burke. Emigration of his son William to America. French and American funds. Popular feeling prevents him from procuring domestic servants.
20. 6 April, 1793. Dr. P. to Mr. W. Politics and commercial affairs. Emigration of all his sons to America.
21. 2 May, 1793. Dr. P. to Mr. W. Public affairs. Monetary Panic.
22. 16 May, 1793. Dr. P. to Mr. W. Thoughts of emigrating to America to join the contemplated college there. State of the affairs of his son-in-law, Mr. William Finch. Prospects of the War.

23. No date (28 May, 1793). Dr. P. to Mr. W. State of the writer's health. Public affairs.
24. 20 June, 1793. Dr. P. to Mr. W. Public affairs. The writer's health. Determination not to emigrate. His publications. Emigration of his sons.
25. 3 July, 1793. Dr. P. to Mr. W. Pamphlets. Public affairs. Visit to Castlehead. Minerals.
26. 15 July, 1793. Dr. P. to Mr. W. Pamphlets. His son's emigration. Public affairs. Compensation for Birmingham Riots.
27. 19 Aug., 1793. Dr. P. to Mr. W. Prospects of the War. Reported rupture with America. Prosecution of Mr. Walker. Emigration of his sons.
28. No date. (About Sept., 1793.) Dr. P. to Mr. W. Determination to emigrate to America. His prospects there. Present from Mr. W. of a sum of money in the French funds. Publication of the heads of his lectures on Experimental Philosophy.
- 28a. 13 Dec., 1793. Dr. P. to Mr. W. French assignats.
29. 2 Dec., 1793. Dr. P. to Mr. W. New publications. Allusion to the riots. Protection of his rights to property in the French funds.
30. 9 Jany., 1794. Dr. P. to Mr. W. Arrival of Mr. Jos. P. in America. Public affairs. Pamphlets. Invitation to Dr. P. to join the college at New York.
31. 25 Jany., 1794. Dr. P. to Mr. W. Public affairs. Letters from America. American land scheme. Pecuniary matters. Emigration.
32. 7 Feby., 1794. Dr. P. to Mr. W. Invitation to visit Dr. P. American land scheme. Regrets at leaving England. Publication of Discourses on the Evidences of Revelation.
33. 14 June, 1794. Dr. P. to Mr. W. Voyage and arrival at New York, and flattering reception there. Money matters. Prospects of war between England and America. Difficulty in obtaining remittances abroad from French funds.
34. 27 June, 1794. Dr. P. to Mr. W. Reception at Philadelphia. Comparison of expense of living in that city and Northumberland. Memorializes the French Convention on the subject of the Funds. Money matters. Prospects of War.

35. 16 April, 1794. Mr. Cooper to Mr. W. Seizure of a French East Indiaman by the French ambassador at Philadelphia. Interference of Dr. P. as a proprietor of Actions des Indes. Dr. P.'s settlement in America.
36. 28 May, 1794. Mr. Joseph P. to Mr. W. American land scheme. State of America.
37. Prospectus of the American land scheme.
38. Copy of agreement for carrying out the American land scheme.
39. 30 July, 1794. Dr. P. to Benjamin Vaughan, Esq., M. P. Observations on America. Public affairs. Plans of life.
40. 26. Aug., 1794. Mrs. P. to Wm. Vaughan, Esq. Observations on America. Settlement at Northumberland.
41. 25 Oct., 1794. Mr. W. Vaughan to Mr. W. Extracts from letter from Dr. P. Failure of American land scheme. Prospect of the Professorship at the College at Philadelphia.
42. 12 Nov., 1794. Dr. P. to Mr. W. Failure of land scheme. Plans of life. Cost of living in America. Pecuniary and domestic matters.
43. 24 July, 1795. Dr. P. to Mr. W. Dispute between Mr. W. and his brother. Increased value of American property. Literary and philosophical pursuits. Answer to Paine. Church History, &c. Prospects of his sons. Pecuniary affairs.
44. 7 Aug., 1795. Dr. P. to Mr. Watson (Mr. Wilkinson's secretary). Letter of condolence. Prospects in America.
45. 17 Dec., 1795. Dr. P. to Mr. W. Death of the Dr.'s son Henry. Wishes his daughter, Mrs. Finch, to join them. Illness of Mrs. Priestley.
46. 15 Nov., 1796 [should be March]. Dr. P. to Mr. W. Mr. W.'s dispute with his brother. Mrs. P.'s illness. Attempt to establish an Unitarian congregation. Visit to the President. State of America.
47. 16 May, 1796. Dr. P. to Mr. Watson. The Wilkinson dispute. The death of Henry Priestley. Sermons on the evidences of revealed religion. Religious sects in America. State of the country.
48. 28 July, 1796. Dr. P. to Mr. Wilkinson. The dispute. Dr. P. chosen President of Northumberland College. Literary and philosophical pursuits. French funds. Pecuniary affairs.

49. 19 Sept., 1796. Dr. P. to Mr. W. Death of Mrs. Priestley. Wishes Mr. and Mrs. Finch to emigrate.
50. 20 Oct., 1796. Dr. P. to Mr. W. The dispute. Mentions Mrs. P. French funds.
51. 3 Novr., 1796. Dr. P. to Mr. W. Long letter on pecuniary transactions between them. Future prospects.
52. 30 Novr., 1797. Dr. P. to Mr. W. French funds. Pecuniary affairs. Subscriptions from philosophical friends. Party spirit. Calumniated as a supposed friend of France.
53. 25 Jany., 1797. Dr. P. to Mr. W. Mrs. P.'s death. Wishes to visit England. Mr. and Mrs. Finch. Narrow escape of William Priestley.
54. 1 April, 1797. Dr. P. to Mr. W. Mr. and Mrs. Finch. Intention to visit France with reference to the French funds. Thoughts of purchasing land there.
55. 11 April, 1797. Dr. P. to Mr. W. The dispute between the brothers. Mr. and Mrs. Finch and Dr. P.'s other children. Visit to France. Money matters.
56. 7 Sep., 1797. Dr. P. to Mr. W. Sends copy from French agent as to French funds. Commercial distress. Mr. and Mrs. Finch. Failing health. Abandons preaching in Philadelphia. Gives up idea of visiting Europe.
57. 21 Jany., 1798. Dr. P. to Mr. W. French funds. Money matters and commercial affairs generally. Increased value of American property and securities.
58. 15 March, 1798. Dr. P. to Mr. W. French funds. Directory make an *arret* in Dr. P.'s favor. Urged to prosecute his claims in France. Talleyrand. Affairs of England and America. Domestic and pecuniary circumstances. Residence and climate in America. Abused as a friend of France.
59. 7 Novr., 1798. Dr. P. to Mr. W. Mr. Joseph P.'s visit to England. Mr. and Mrs. Finch. Pecuniary situation in consequence of Mr. Vaughan's failure. Peace-making.
60. 25 Decr., 1798. Dr. P. to Mr. W. Mr. and Mrs. Finch. Human character.
61. 14 June, 1798. Dr. P. to Mr. W. Money matters. Literary and philosophical pursuits. French funds. Mr. Joseph P.

62. 14 June, 1800. Dr. P. to Mr. W. Money matters. French funds. Talleyrand and the French Government. Scientific pursuits. Contributions from English friends of science. Public affairs.
63. 17 July, 1800. Dr. P. to Mr. W. Money matters. Scientific pursuits. His devotion to that object. His children.
64. 15 Decr., 1800. Dr. P. to Mr. W. Settles his affairs. Scientific pursuits and contributions in aid of them. Calumny. Vindicates himself in a letter to the inhabitants of Northumberland.
65. 30 April, 1801. Dr. P. to Mr. W. Scientific and Theological publications. Position in America. Letter from the President. Trials of life. Recovery from illness.
66. 21 March, 1801. President Thomas Jefferson to Dr. P. Complimentary letter (a copy).
67. 31 July, 1802. Dr. P. to Mr. W. Publication of two new works. Sends copy of a second letter from the President. French funds.
68. 19 June, 1802. President Jefferson to Dr. P. (a copy).

*Memorandum.* Some other letters of Dr. Priestley and his son, either of a private nature or relating only to subjects of business, have been retained out of this correspondence, and are among Mr. Wilkinson's papers in the hands of the solicitors to the family.<sup>1</sup>

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<sup>1</sup> For some account of this correspondence see paper by J. Fickett Marsh, read to the Historic Society of Lancashire and Cheshire, April 19, 1855. *Memoirs of the Society*, Vol. VII. Liverpool, 1855. 8vo. (17 pp.).

## APPENDIX.

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- I. THE LIKENESSES OF JOSEPH PRIESTLEY IN OIL, INK,  
MARBLE, AND METAL. BY H. CARRINGTON BOLTON.
- II. THE LUNAR SOCIETY, OR THE FESTIVE PHILOSOPHERS  
OF BIRMINGHAM 100 YEARS AGO. BY H. CARRINGTON  
BOLTON.
- III. INVENTORY OF DR. PRIESTLEY'S LABORATORY IN 1791.





## I. THE LIKENESSES OF PRIESTLEY IN OIL, INK, MARBLE, AND METAL.

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THE most youthful portrait of Dr. Priestley with which we are acquainted is that commonly known as the "LEEDS PORTRAIT." (1)

The unknown artist represents Priestley at the age of thirty, when he was a teacher at the Warrington Academy. It shows his full face, slightly turned to his left, and half length, with a clerical dress, and in a full bottomed wig; in his right hand, the only one shown, he holds a small book (Bible?) between his thumb and fingers. The background is perfectly plain. This portrait was formerly in the possession of Mrs. Bilbrough, *née* Ellen Priestley, and was probably brought from Fieldhead by Dr. Priestley's sister, Mrs. Crouch, when she moved to Gildersome, in 1787. Mr. Crouch having died in 1786, his widow went to live with Mr. William Hudson, Gildersome, near Leeds; and this portrait used to hang with others in his dining-room. Of it Mr. Hudson used to relate the following anecdote: The picture was once placed in the window of a carver and gilder's shop, in Leeds, when Dr. Priestley in passing by stopped to look at it. A woman happening to be doing the same, noticed Dr. Priestley, and exclaimed: "Why here's the fellow himself!"

In 1860 this was photographed (2) by Messrs. Caldesi, Blanford & Co., 18 Pall Mall, East, London, and copies have been exhibited at various times. One is preserved in the Yates Memorial volume, at the Royal Society; one is in the Timmins Memorial Collection at the Reference Library, Bir-

mingham. For our copy we are indebted to Dr. Jas. F. Priestley, of Des Moines, Iowa.

The second portrait of Priestley, (3) judging by the apparent age of the subject, is one which we shall call the "VAUGHAN PORTRAIT" after the family in whose possession it has been nearly one hundred years. The artist is again unknown; Priestley is shown half length, but no hands are visible; his face is turned to his right hand, and he wears a wig. The workmanship seems to be inferior.

This portrait (together with one of Priestley's wife) was presented by him in 1791 or 1792 to his friend Mr. Benjamin Vaughan, who had been his pupil at the Warrington Academy and who gave him a refuge at the time of the Birmingham riots in July, 1791. Mr. Vaughan brought the portraits to America in 1795; he settled in Hallowell, Maine, in 1797, and died there Dec. 1835, aged 84 years. The frames of the portraits suffered damage in the transportation. These portraits are now (1891) in the possession of Mr. W. M. Vaughan, of Cambridge, Mass., grandson of Benjamin, and who has kindly consented to have them photographed for the first time. (4)

THE OPIE PORTRAIT. (5) The eminent English artist John Opie, Professor at the Royal Academy, painted the portrait of Dr. Priestley at the residence of Mr. J. Johnson, London, the latter's book publisher and friend. It represents head and bust; three-quarters face turned to his right; he wears a wig, is dressed in the usual clerical habit and white stock. The top button of the vest is unfastened leaving a small v-shaped opening. Opie's Portrait formerly belonged to the Rev. Mr. Hole, and afterwards to Mr. Barham, of Exeter, who bequeathed it to the Manchester New College, London, where it now hangs in University Hall.

Of this portrait there are several reproductions known to us. The Arundel Society some years ago published a photograph of it. (6) An engraving was made by Caldwell and published May 1st, 1801, by Dr. [Robert John] Thornton, in his "New Illustrations of the Sexual System of Linnæus

and the Garden of Nature," London, 1801, imp. folio. (7) Priestley's head is in an oval medallion grasped by the claws of an eagle whose head and wings project above and on either side. Beneath the oval is a ribbon bearing the words "Dr. Priestley." The medallion and the eagle are backed by clouds and sky.

Beneath this on the same page is an engraved portrait of Lavoisier, from a painting by David. Lavoisier's face is nearly full, eyes are turned upward and to his right, he wears a wig, and a ruffled shirt with white stock. The portrait is in an oval surmounted by a garland and ribbon, and from beneath flows another ribbon with the word "Lavoisier."

Above these two portraits are the words: "Chemical Philosophers of the Present Day," and beneath the names of the artists and engraver as given, also the name of the publisher and date.

The size of each medallion is 100 mm.  $\times$  80 mm., and the page measures 46 cm.  $\times$  32 cm.

I. HAZLITT'S PORTRAIT (8) was painted about 1788. It represents Priestley's head and shoulders, the face turned towards his left. He wears a square-cut wig with two rows of curls, instead of three as in most other likenesses. His clerically cut coat shows four buttons.

This was engraved by W. Nutter and published "April 14th, 1789, by I. Hazlitt, No. 65 Margaret Street, and sold by R. Cribb, No. 288 High Holborn." The portrait is in a small oval measuring 68  $\times$  58 mm. Beneath is the legend: The Rev'd. Joseph Priestley, L.L.D., F.R.S., &c., together with the publishers's name as given. (9)

Mr. Yates thinks this was the earliest *engraved* portrait of the chemist.

ARTAUD'S PORTRAIT. (10) Shortly before Priestley left for America, in 1794, he gave sittings to the artist Artaud, a favorite artist with Dissenters. This represents Priestley seated at a table, full face, half length; he wears a wig, clerical habit, high-cut waistcoat showing seven buttons, of which the topmost is unfastened, and the usual white stock. In his

right hand he holds a quill pen, his arm resting upon writing paper on a table. On this table are an inkstand, a book (only partially shown) and part of a glass flask. His left arm hangs down so as to conceal the hand. In the background appear drapery and a panel.

In 1804, the original was disposed of for fifteen guineas, and presented to Dr. Williams' Library, the amount being raised by subscriptions of one guinea each. (Rutt's *Life of Priestley*, II., 291.) It now hangs in the Library named, Grafton St., London.

From Artaud's portrait T. Holloway made an engraving in folio size—(31 cm.  $\times$  23.4 cm.) It bears the legend: Joseph Priestley, L.L.D., F.R.S., and the name of the Artist and Engraver. For a copy of this engraving we are indebted to Mr. Conyers Button, of Germantown, Pa. (11)

We have in our possession a fair lithographic reproduction of the head of Priestley, by Artaud, (12) which was part of Plate xxiii., of Lavater's *Physiognomy*.

**THE FUSELI PORTRAIT.** (13) This, the largest oil portrait of Dr. Priestley (three feet four inches by four feet two inches), was painted for Joseph Johnson, bookseller and publisher of Priestley works, in the year 1783, while Dr. Priestley was Johnson's guest. (Knowles' *Life and Writings of Henry Fuseli*, London, 1831, Vol. I., p. 407.) It represents Priestley three-quarters' length, seated in a high backed chair with a square top; he wears a wig, his face is turned to the left, showing about seven-eighths profile. He wears a stock and ruffled shirt. His left arm rests on a table, near open and closed books on manuscript. Two fingers of his right hand, open, rest on his right knee, which is thrown across his left leg. His coat shows three buttons. The portrait is preserved in Dr. Williams' Library, London.

Of Fuseli's portrait an engraving was made by C. Turner, and published (100 copies only), in October, 1836, by Richard Taylor, Red Lion Court, Fleet Street, London. The plate measures outside, 14  $\times$  10 inches (356  $\times$  255 mm.), inside, 11 $\frac{1}{8}$   $\times$  8 $\frac{3}{4}$

inches ( $282 \times 211$  mm.). (14) We have seen a copy of this rare engraving in the Hope Collection, Bodleian Library, Oxford.

An engraving after Fuseli, by E. Wentworth, is published in Robert K. Dent's "Old and New Birmingham." Birmingham, 1879. Three sections. 4to. Page 211. (15)

A photograph of Fuseli's portrait was published by the Arundel Society of London. (16)

An oil portrait by I. MILLAR, (17) executed in 1789, is in the possession of Priestley's granddaughter, Mrs. Robert A. Wainewright, of London. Yates gives the date of this as 1776 or 1777, but the canvas bears the date we have given. A pendant portrait of Mrs. Priestley is also in Mrs. Wainewright's possession. These, so far as we know, have not been reproduced.

A portrait by PETER HOLLAND, (18) drawing-master at Gateacre, near Liverpool, is named by Mr. Yates, but we have not succeeded in tracing it. In 1860 it was in the possession of Thomas Thornely, Esq., of Liverpool. Yates says it was similar in style to that by Millar, but inferior.

THE STUART PORTRAIT. (19) The distinguished American artist, Gilbert Stuart, born at Narragansett, Rhode Island, in 1756, and died in 1828, executed a portrait of Dr. Priestley at the request of the American Philosophical Society of Philadelphia; this must have been between the years 1794 and 1800. The contract price of fifty guineas was paid to Stuart, who, however, delayed finishing the work, especially the drapery, and took it with him to Boston. There it was accidentally seen by Mr. Barclay, of Wavetree, near Liverpool, a friend and admirer of Dr. Priestley, then on a visit to the United States. Stuart, whose eccentricities are well known, sold the portrait for fifty guineas to Mr. Barclay, who took it to his home and had it finished by Artaud in 1812. At the death of Mr. Barclay it was left to Mr. Rathbone, of Liverpool, who is said to have placed it in a public museum of that city. We have not, however, been able to trace it.

While in Mr. Barclay's possession three full-sized copies were made; one of these was kept by Mr. Priestley, the Doc-

tor's son, and is now preserved by his grandchildren in Northumberland, Pa. (20) The second went to Mr. George Skey, Hackney, and was afterwards bought by Mr. Joseph Parkes, husband of a granddaughter of Dr. Priestley. It is now in the possession of Mme. Belloc, Mr. Parkes's daughter, and hangs in a private house in Westminster. (21) The third went (we are informed) to Miss Mansell, of Birmingham, and was left by her to Cambridge University. (22) Mrs. Wainwright, granddaughter of Dr. Priestley, informed me these three copies were made by Artaud.

Besides these small copies were made, one of which is now in possession of the widow of Dr. James Russell, of Birmingham. (23) Another is owned by Mme. Belloc; (24) another fell to Mrs. Bowen, a granddaughter of Dr. Priestley, and was taken by her to Australia. (25) Still another of these is in possession of Mrs. Wainwright, of London. (26)

These particulars have come to us from several sources, chiefly through the owners of the portraits themselves. Mrs. James Russell, to whom we are under special obligations, adds some details concerning her own copy; she writes: "My copy was certainly procured by Mr. Abel Peyton, of Edgbaston, for presentation to Miss Lucy Finch (then living in his house), a granddaughter of Dr. Priestley, whence it went to her sister, Miss Catharine Irene Finch, and thence by will to me (Dr. Jas. R.). Whether my copy is an original one, or a second copy seems uncertain, probably the latter. Mme. Belloc says her small copy is by Artaud, of Liverpool. Mr. Pickersgill, the artist, in examining mine, gives it as his decided opinion that it was painted by his Uncle Witherington, but whether from the original he does not say."

(From an inscription on the Russell copy, communicated by Sam: Timmins, Esq., of Birmingham.)

Yates in his Memorials of Dr. Priestley refers to a small copy by Artaud, made for Mr. Charles Knight, bookseller. (27)

The fact is, that the neglect of artists to place their initials or other distinguishing marks on portraits, and copies of por-

traits, and the time of execution, causes great perplexity to those who a half century later make efforts to identify them.

In Stuart's painting, Priestley's head and shoulders are turned slightly to his left; he wears no wig, his hair is parted in the middle and hangs low behind; he is dressed in a clerical habit with a white stock. No coat-buttons are visible.

This has been frequently copied by engravers. The engraving by J. Partridge, portrait painter to the Queen, (28) bears the inscription: Joseph Priestley, L.L.D., F.R.S.; Stuart's name is misspelled—"Stewart Pinxt." The plate measures 235 mm.  $\times$  150 mm., the actual bust 100 mm.  $\times$  80 mm. This has been issued with several works of Priestley, his "Memoirs" (London, 1806, 2 vols. 8vo.), and the "Monthly Repository" vol. X. (1815).

Stuart's portrait was more skilfully engraved by W. Holl. This was published about 1833, by "Charles Knight, Ludgate Street and Pall Mall, East, London, under the superintendence of the Society for the Diffusion of Useful Knowledge." In this form it was issued with Knight's Gallery of Portraits (London, 1833, 7 vols. roy. 8vo.), and bears the legend: "Priestley. From a picture by Gilbert Stewart in the possession of T. B. Barclay, Esq., of Liverpool." The size of the plate is 132 mm.  $\times$  105 mm. (29)

The engraving is a faithful copy of Stuart's portrait and requires no further description. The background is perfectly plain. Stuart's name is again misspelled.

A reproduction of Knight's plate, with the substitution of a facsimile of the signature of Joseph Priestley for the legend above given, was issued with vol. vi., No. 21, 1889, of the *Asclepiad*, in connection with an essay on the "Discovery of Vital Air," by Dr. B. W. Richardson, the editor. (30)

A small engraving, evidently after Stuart, was issued with the Biographical Magazine (London, 1794). The head and shoulders of Priestley are in an oval, 54 mm.  $\times$  42 mm., and the engraver's name is given as W. Holl. Beneath is the legend: Dr. Priestley; followed by a biographical sketch of 45 lines, completed on the same page. (31)



Another copy from Stuart (or from Holl?) was engraved by C. Cook, and issued in Muspratt's Chemistry, published by William Mackenzie (Glasgow, Edinburgh, London, and New York, 1859, 2 vols. 4to.). The plate measures  $152 \times 120$  mm., and beneath is the legend: Joseph Priestley, L.L.D., F.R.S., and the publisher's name as above given.

The background shows a panel, and to the left portion of a curtain and of a chair-back with a circular top. This is apparently an addition by the engraver. (32) A copy of the above showing the head only, by an unnamed engraver, was issued with the Popular Science Monthly for August, 1874. (D. Appleton & Co., New York.) The inscription is merely: "Dr. Joseph Priestley." The size of the actual engraving (head) is about  $130$  mm.  $\times$   $100$  mm. (33)

Priestley's head in an oval evidently engraved after Stuart (or some copy of Stuart) in a very inferior manner, is printed on the same page with equally poor portraits of Blair, Lavater, Abercrombie, and Moreland. The size of the oval is  $46$  mm.  $\times$   $40$  mm., that of the page about  $152 \times 102$  mm. (34)

The source of this we have not ascertained, the page has evidently been torn from some 12mo. volume.

We have seen still another engraving after Stuart, by an unknown artist. In an oval measuring  $135 \times 110$  mm.; the space within the oval is of a light green tint. The legend is simply: Priestley. (35) (In possession of Mr. Conyers Button.)

Samuel Smiles' Lives of Boulton & Watt (London, 1865), contains an inferior engraving after Stuart's portrait (page 371). (36)

**MANSELL PORTRAIT.** (37) Portrait by an unknown artist, which was formerly in the possession of Mrs. Judith Mansell, of Birmingham, an intimate friend of Dr. Priestley. It was carried off by the rioters from Fair Hill, Priestley's residence, in 1791, and afterwards sold in Birmingham. It is now preserved in the Library of University Hall, Manchester New College, Gordon Square, London.

The Mansell portrait shows three-quarters profile, with wig and curls; a clerical habit; white stock; two frills of the

shirt bosom show at the opening of the vest. Priestley's right hand is thrust beneath his coat leaving exposed only a small part of his wrist. The canvas represents an oval frame of brown color. The size is the same as that by Opie.

**PEALE PORTRAIT. (38)** The New York Historical Society owns a portrait by Rembrandt Peale; this formed a part of the Peale Collection in Philadelphia, and was presented to the New York Society by Mr. Thos. J. Bryan.

It shows Priestley's three-quarter face turned towards his left; clerical habit and white stock; close-fitting vest. Apparently taken when advanced in years. No wig, his hair being parted at the side.

We are indebted to the officers of the N. Y. Historical Society for the permission, and to Dr. Louis H. Laudy, of Columbia College, for a photographic copy of this likeness. (39)

**BUTTON PORTRAIT. (40)** 'A portrait in oil, presumably by C. W. Peale, formerly the property of Priestley's friend, Mr. John Vaughan, has recently come into the possession of Mr. Conyers Button, of Germantown.

It shows Priestley's face three-quarters, head and bust; hair rather thin, no wig. His vest is closely buttoned up leaving only a white stock visible; his coat is of clerical cut, without lapels and shows three large buttons. This we shall call the "Button Portrait" after the present owner, who has kindly presented us with a photographic copy. (41)

This original portrait has been engraved as a small vignette, by Mr. Jacques Reich, of New York, for Appleton's Cyclopædia of American Biography, where it appears in connection with the article on Priestley; size about 38 × 25 mm. (42)

**WISTAR PORTRAIT. (43)** An oil-portrait by an unknown artist, but which we shall call the "Wistar Portrait," is in possession of the American Philosophical Society, Philadelphia. This was presented to the Society on April 3d, 1818, by the widow of Dr. Caspar Wistar. It represents Priestley's head and upper shoulders; he wears no wig, and his hair parted at the side and features shows he was much older than when he

sat to Stuart. He wears the usual white stock and a closely buttoned up vest. (44)

For a photographic copy of this we have to thank Mr. Conyers Button, of Germantown.

THE SHARPLES PORTRAIT. (45) In 1886–87, James Walter exhibited in many cities of the United States a collection of fine portraits, which included two of Washington, one of his wife, seven of prominent American women, and one of Dr. Joseph Priestley. The latter was said to have been painted from life in Philadelphia in 1794 or 1795, by the artist James Sharples. Priestley's head is shown without a wig, his hair parted in the middle and hanging low behind; his face turned slightly to his left, with a white stock and ruffled shirt bosom. A full account of this and the other portraits was published in "Walter's Memorials of Washington" (New York, 1887, 8vo.). The Academy of Fine Arts in Boston threw some doubts upon the authenticity of the Sharples Portraits and the collection was returned to England.

An autotype reproduction of the Sharples portrait (46) prepared in London, accompanied the volume named.

A portrait in pastels by Mrs. Sharples (47) is preserved in the Kensington National Portrait Gallery (Bethnal Green), London, to which it was presented by James Yates in 1864. "This is a bust portrait on a small scale, turned towards the right, wearing a plain black coat and a high waistcoat of the same color, showing a little of the shirt-frill projecting beneath a close-fitting white cravat; is close shaven, pale face seen three-quarters to the right, the blue-gray eyes looking at the spectator. The hair is brown-gray and combed straight down to the forehead; the lips are pale-red, and there is a cleft in the chin. Background shows indistinctly the folds of a bluish-green curtain. Size,  $9\frac{1}{2} \times 6\frac{1}{2}$  inches ( $241 \times 165$  mm.).

Another pastel portrait by Mrs. Sharples (48) is in possession of Dr. William J. Russell, P.C.S., F.R.S., London. It is similar to the above, and measures  $9 \times 7$  inches ( $229 \times 178$  mm.), in oval form.

All the aforementioned portraits and engravings give a full or three-quarter view of Priestley's face ; a certain number show his sharply-defined profile.

The original source of most of these were the famed "Wedgwood Medallions," which, in several sizes, formed one of the popular likenesses of Dr. Priestley current in the last century. Of this Miss Meteyard, the biographer of Josiah Wedgwood, writes : " In one form or another, and in various bodies, Priestley's likeness was being incessantly reproduced. In the houses of Dissenters it was a conspicuous ornament, and after he had given to the world his discovery of oxygen the resemblance of this great man, either as a full-size medallion, or as a bust, was largely bought by continental savants" (ii., 451). Wedgwood presented one of these medallions to Miss Aiken, afterwards Mrs. Laetitia Barbauld. It was from a design by either Flaxman or Hackwood, and is supposed by Mr. Yates (*Memorials of Priestley*) to date from the year 1765. Miss Meteyard, however, remarks : " This is far too early, to none of the cameos can be assigned an earlier date than 1769 or 1770. In 1765 Flaxman was only eleven years old."

• (49) THE WEDGWOOD MEDALLIONS were, we believe, of three sizes ; we have seen one measuring about  $9\frac{1}{2} \times 7\frac{3}{4}$  inches ( $240 \times 197$  mm.), and another  $3\frac{1}{8} \times 3$  inches ( $98 \times 77$  mm.). They are oval disks, with Priestley's profile and bust in white relief on a blue ground. Priestley wears a wig, having three rows of curls in the back of his neck ; he wears a white stock, and his parted coat exposes a portion of his shirt bosom ; the side of his coat from the spectator has a peculiar fold, which reappears as a characteristic feature in the engravings made after the medallion. It will be found pictured in Meteyard's *Life of Josiah Wedgwood*, vol. i., p. 310, engraved by Pearson. (50)

Besides this medallion, Wedgwood modelled in May, 1779, a life-size bust of Priestley (51) to match those of Franklin and Newton. Also enlarged bas-reliefs in the style of the medallion, of which plaster copies exist. (52)

An engraved copy of the Wedgwood medallion, (53) exe-

cuted by an unnamed artist, was issued with the *Westminster Magazine* for July, 1782. The position of the head is reversed, and the bust is placed in an oval frame, on which are the words, "Joseph Priestley, L.L.D., F.R.S." Above, and hanging down over the frame, are clusters of flowers, somewhat conventionalized; beneath, and at the side of the frame, is scroll-work. This frame, with its accessories, rests upon a moulding against a panelled wall; beneath it is grouped philosophical apparatus, comprising a frictional electric machine, two Leyden jars, model of a house with lightning-rod attached, a pair of dividers, an artist's palette with brushes, crayon holder and parallel ruler, and three books, one lying open. These rest upon a raised plane. Beneath the plate, which measures 93 mm.  $\times$  56 mm., are the words: "Published as the Act directs, 1 Feb., 1782, by J. Walker, Paternoster Row."

The *European Magazine* for August, 1791, (54) published a bust of Priestley, apparently from the Wedgwood medallion. The head shows the left side; the chief peculiarity of this engraving, aside from the accessories to be named presently, lies in the disposition of the shirt collar, which is open under the chin, showing two unfastened buttons. The bust is in a circle, beneath which, on the left, stands a female in the act of discharging a Leyden jar, which is supported on a raised dais; on the right side two cherubs are blowing and playing with soap bubbles, a dish being near on the dais. The plate was engraved by W. Bromley, and published by J. Sewell, Cornhill, Jan. 1st, 1791. Beneath the plate, which measures 125 mm.  $\times$  75 mm., is the legend: "Joseph Priestley, L.L.D., F.R.S." Above the plate are the words: "European Magazine."

A faithful copy of the Wedgwood medallion was engraved by Angus, (55) and published "as the Act directs, 1 Feb., 1792, by C. Forster, No. 41, Poultry." It was issued with a number of the *Literary Magazine*. The oval is a trifle larger than the medallion, measuring 100 mm.  $\times$  81 mm., instead of 98  $\times$  77. Beneath is the legend: "J. Priestley, L.L.D., F.R.S." and above, the words: "Literary Magazine."

On April 20th, 1794, H. Simmonds published an engraving by the artist G. Murray, (56) which shows Priestley's profile looking to the right, but he wears an ordinary coat instead of a fancy robe. It is in an oval, and apparently based on the Wedgwood medallion.

An engraving much like that of Angus, but on a square background, stippled instead of lined, was executed by Mackenzie (57) "from a Basso Relievo modelled from the Life," and published July 31st, 1805, by A. Tilloch, Carey Street. Beneath the square is the legend: J. Priestley, L.L.D., F.R.S., the name being in script. The square measures 100 mm.  $\times$  85 mm.

An inferior copy of the above bears the name of the engraver, Fr. Leopold, *fec.* 1807. The square is of exactly the same size, and beneath it is the legend, in script: "Joseph Priestley." (58)

Ambroise Tardieu, (59) the well known French engraver, executed in his neat style a portrait after the Wedgwood medallion. The bust has been replaced by an ample extension of the cloak; the head shows Priestley's left side. In an oval measuring 105 mm.  $\times$  78 mm. Beneath the oval are the words: "Dessiné et gravé par Ambroise Tardieu," and the legend: "Joseph Priestley (Physicien et Chimiste), membre de la Société Royale de Londres. Né à Fieldhead (Comté d'York) le 18 Mars 1733; mort à Northumberland (Etats Unis d'Amérique) le 6 Février, 1804."

An engraving by Hopwood (60) closely resembles that of Tardieu, but differs in showing a ruffled shirt instead of a plain one. The oval background is stippled and measures 84 mm.  $\times$  66 mm. Beneath the oval is the legend (in script): Rev'd. Joseph Priestley, L.L.D., F.R.S. This was published by H. D. Symonds, June, 1804.

Wilkes Grafton & Co., Birmingham, published in John Corry's *Life of Priestley* (Birm., 1804), (61) a small engraving somewhat in the style of Hopwood's, but stiffer in execution. Priestley's right face is shown, his nose being long and sharp, the wig has three rows of curls, the high cut coat shows four

buttons. The whole is in a stippled oval measuring 74 mm.  $\times$  60 mm. Beneath is the legend: "Jos<sup>h</sup>. Priestley, L.L.D., F.R.S."

Alexander Hogg & Co. (62) published December 1st, 1807, an engraving of which the Birmingham Library (Timmins Collection) preserves a copy. Priestley's profile, looking to the right with a wig, is in an oval. The clerical coat shows three buttons; he wears a white stock, but has no shirt frills. The legend reads: The Celebrated Priestley, L.L.D., F.R.S. Died in North America, Feb. 6, 1804, aged 71. It measures about  $3\frac{1}{8} \times 2\frac{1}{4}$  inches (80  $\times$  57 mm.).

(63) We have seen an engraving described as follows: Head and shoulders; profile showing left side of face; with a wig; wearing a white stock and clerical habit with four buttons exposed. *Legend*: "Joseph Priestley, L.L.D., F.R.S., and member of many foreign literary societies. He was born March 18th, 1733, at Field-Head, near Leeds, in Yorkshire, and expired Feb'y. 6th, 1804, in the 71st year of his age. His publications are numerous, and in his mental constitution were united ardour and vivacity of intellect with placidity and mildness of temper. In the domestic relations of life he was uniformly kind and affectionate. Not malice itself could ever fix a stain on his private conduct or impeach his integrity. Such was the man who has added one more imperishable name to the illustrious dead of his country." [Published by] William Darton, 58 Holborn Hill, London, 1822. Size about 11  $\times$  8 cm. (including legend). Issued with Darton's Cabinet of Portraits (No. 53), London, 1822.

(64) "Grape" is the name and Göttingen the locality responsible for a silhouette of Dr. Priestley, apparently after the Wedgwood medallion. The left side of his face is turned towards the observer; the bust is in an oval frame above which hangs a garland of flowers, and beneath which is an open book entwined in flowers and resting on a square frame within which is the legend: Jos. Priestley. The plate measures 140 mm.  $\times$  80 mm. As a likeness it has no value.

(65) Another and more creditable silhouette of Priestley is

found in a work entitled : "Profiles of Warrington Worthies collected and arranged by James Kendrick, M.D.," London, 1854, 4to., 11 pages. (Plate 4, page 9.)

(66) An engraving of Priestley's head and half of the body was published in Priestley's *Notes on Scripture*, by D. Eaton, 187 High Holborn, which is remarkably ill-featured. It is said by Yates to be copied from a crayon drawing executed in America. His head is turned so as to show his left side ; he has no wig, his hair hangs low in the neck behind, the expression of the lips is hard and unlike other profiles in that the chin recedes less. He wears a white stock, a waist-coat buttoned up so high as to expose no bosom, and carrying four buttons. His high-cut coat is open. His left arm is shown nearly to the elbow. The whole is in a square 107 mm. long and 85 mm. wide, beneath which is the inscription : "Joseph Priestley, LL.D., F.R.S. Ac. Imp. Petrop. R. Paris. Holm. Taurin. Ital. Harlem. Aurel. Med. Paris. Cantab. Americ. et Philad. Socius. Born Mar. 13, 1733 ; Died Feb. 6, 1804.

This engraving is bound up with some copies of Rutt's *Life and Correspondence of Priestley*.

(67) The same engraving but in an oval and reduced to 106 × 81 mm. in size, was issued with vol. iv. of Dr. Priestley's *Notes on All the Books of Scripture*, London, 1803, and Northumberland, 1804. It bears the words : Published March 12, 1805, by J. Johnson, St. Paul's Church Yard. The plate was in the possession of Mr. W. Matthews in 1831. (*Rutt's Life*, II., 291.)

(68) A lithographed reproduction of the last named was issued as a supplement to the *National Bottlers' Gazette*, New York, April, 1882. It is enlarged to 178 mm. × 138 mm. Beneath the oval is the inscription : "Joseph Priestley, LL.D., F.R.S. Father of Carbonated Waters. Born March 13, 1733 ; died February 6, 1804."

*Caricature of Priestley.* (69) Full length figure in action ; left foot stamps on the open Bible and other works ; on the open book the words "Bible explained away." In his right hand



raised above his head, a roll of MS. with the words "Political Sermons," from within the roll issues smoke; in his left hand a MS. with the words, "Essay on Government," also in flames; clerical habit with pockets stuffed with MSS., in the left side a paper inscribed "Revolution Toasts," in the right pocket papers inscribed "Essays on Matter and Spirit," and "Gunpowder." On his head a wig, face in profile; wears knee-breeches, and shoes with buckles. Legend: Doctor Phlogiston, the Priestley politician or the political Priest! Annabal Scratch fecit. Published as the Act directs by W. Locke, July 1st, 1791. Size of plate, 14 cm.  $\times$  8.8 cm. This was issued in the Attic Miscellany, July, 1791, and is designated as Political Portrait No. 4.

(70-71) The Timmins Collection at Birmingham, contains further two shocking colored caricatures, whose coarse and villanous representations would in modern times be regarded as good cause for an action for libel. We do not care to describe these; one is entitled: "The Treacherous Rebel and Birmingham Rioter," and the other "The Friends of the People, Priestley and Tom Paine."

In J. R. Smith's Catalogue of Portraits mention is made of an 8vo. caricature, entitled the Mystical Philosopher, 1796. This we have not seen. (72)

#### LIKENESSES IN STONE.

One of the earliest busts, was a small one by Halliday, (73) a resident of Birmingham and a friend of Priestley. A copy is preserved in Dr. Williams' Library, London, and plaster copies were not rare.

Among the many likenesses of Priestley two full length marble statues are of interest. The first of these was erected in the Oxford University Museum, June, 1860, and was executed in Caen stone by the sculptor, E. B. Stephens. (74) It shows Priestley full length in clerical dress and knee-breeches. His head carries a wig, the eyes are directed forwards and slightly upwards; his right arm is bent at the elbow with his hand raised and index finger extended as if gesturing; his left

arm hangs lower, the hand holding a roll of MS. He wears a ruffled shirt and wristbands, and the garments hang loosely on his spare frame. An outline of some physical apparatus is delineated on a short column at his left side. He stands on a bracket bearing the word "Priestley."

Of this we possess a good photograph. (75)

A second full length statue was erected in Birmingham in August, 1874, being the one hundredth anniversary of his discovery of oxygen. (76) The statue was executed by J. F. Williamson, and represents Priestley in the act of isolating oxygen; he stands by a short column on which is resting a small basin and a closed tube, the latter being held in position by his left hand. In his right hand he holds, between his thumb and second finger, a lens. His head is inclined forward slightly, and the eyes are directed downward as if looking at the experiment. His dress is quite similar to that of the Stephens statue.

Of Williamson's statue G. Stodart made an engraving in 1875; this was issued with the Art Journal (D. Appleton & Co., New York). (77) The plate measure about 250 mm.  $\times$  150 mm., and bears the legend: "Dr. Priestley." (77)

It was also engraved (in a cheap style) for a little brochure, published in 18mo. at Paris (1875), by Fonvielle: *Célébration du premier centenaire de la découverte de l'oxygène [à Paris]*. (78)

The Tablet erected in the New Meeting House, Birmingham, (79) to the memory of Dr. Priestley is after designs by the artist, Hollius, but the profile is by P. Rowe, of London. The inscription, written by the celebrated Dr. Parr, is as follows:

"This Tablet is consecrated to the memory of the Rev. Joseph Priestley, L.L.D., by his affectionate Congregation, in testimony of their Gratitude for his faithful attention to their spiritual improvement, and for his peculiar diligence in training up their youth to rational piety and genuine virtue: Of their Respect for his great and various talents which were uniformly directed to the noblest purposes; and of "their veneration for

the pure, benevolent, and holy principles which, through the trying vicissitudes of life and in the awful hour of death, animated him with the hope of a Blessed Immortality. His Discoveries as a Philosopher will never cease to be remembered and admired by the ablest improvers of science. His firmness as an advocate of liberty, and his sincerity as an expounder of the Scriptures, endeared him to many of his enlightened and unprejudiced contemporaries. His example as a Christian will be instructive to the wise, and interesting to the good of every country and in every age. He was born at Fieldhead, near Leeds, in Yorkshire, March 13, A.D. 1733, was chosen a minister of this chapel, Dec. 31, 1780; continued in that office ten years and six months—embarked for America April 7, 1794. Died in Northumberland Town, in Pennsylvania, Feb'y 6, 1804. Unitarian Chapel, Birmingham. Halliday, F."

Various institutions of learning, in Europe and America, have honored the memory of Priestley by inserting in their walls medallion portraits of terra-cotta; such an one is found in the Chemical Laboratory at Budapest, Hungary. (80.)

#### LIKENESSES IN METAL, ETC.

Dr. Priestley's likeness has also been perpetuated by numerous medals and tokens in silver, bronze, and copper.

An oval brass medallion showing Priestley's head in relief; (81) he wears a wig which hangs low in the neck behind. His coat shows four buttons and the parted waistcoat a ruffled shirt. The oval measures 107 × 92 mm.

A handsomely executed medal, by Phipson, (82) was struck to commemorate Priestley's emigration to America. It exists in both silver plate and in bronze, with, however, a slight difference to be noted. This medal is 55 mm. in diameter; on the obverse is Priestley's head in relief; he wears a wig, and the parted waistcoat shows a ruffled shirt; there are two buttons on the waistcoat. The legend on the obverse is: "Josephus Priestley, Phipson fecit;" on the reverse around an outer circle: "Magnus Christianus Philosophus," and within the circle: "Apr. VIII., Britannia litora linguens

Columbiam advenit Junii IV.," and beneath this: "Natus Mar. 13, 1733; mort. Feb. 6, 1804."

The bronze medal is a facsimile of the silver one, except that the legend "Magnus Christianus Philosophus" is replaced by "I Decus I Nostrum melioribus utere fatis." (83)

A somewhat smaller bronze medal was executed in 1783 by I. G. Hancock. (84) It measures 36 *mm.* in diameter. Priestley's head with a wig; the parted shirt-collar open under the chin shows two unfastened buttons, a peculiarity noted in Bromley's engraving; above and around the head the words, "Josephus Priestley." The obverse is filled by a chemical table and apparatus. On the table is a pneumatic trough, in which stand five wide cylinders and one narrow tube; beneath this are two shelves, on which lie open books, flasks, tubes, crucible, tongs, and a mallet. To the right of the table is a frictional electric machine, to the left a furnace, and a mercurial trough in which stand two small cylinders; beneath the table the date "1783."

A copper token, 30 *mm.* in diameter, bears no date. (85) Priestley's head with a wig; the shirt-collar is open beneath the chin, and shows two unfastened buttons as in Bromley's engraving; around the head the legend, "J. Priestley, Citizen of the World." The reverse shows an altar with flame arising from the centre of the upper side; on the front of the altar an oval containing the words "Hampden and Sidney;" above the altar rays of light proceed from a central point. Legend, "Sacred to Liberty."

Halliday (86) executed, both in bronze and in block-tin, medals 52 *mm.* in diameter, showing on the obverse Priestley's profile, with a wig, and bearing this inscription: "Joseph Priestley, L.L.D. F.R.S. Ac. Imp. Petrop. R. Paris. Holm. Taurin. Ital. Harlem. Aurel. Med. Paris. Cantab. Americ. et Philad. Socius. On the reverse is Dr. Parr's inscription previously given. (P. 189.)

The American Philosophical Society, of which Priestley was an honored member, received at different times presents of likenesses of the chemist. Mr. John Vaughan, Sept. 16,

1791, presented the society with a profile in plaster of Paris, "particularly valuable for the resemblance." (87) The same gentleman, on April 1, 1803, gave another plaster medallion to the society, (88) and Mr. Patterson, April 6, 1804, shortly after Priestley's death, gave the society a profile in black leather. (89)

Besides the great variety of forms in which Priestley's face has been delineated, already enumerated, there are doubtless many more. We can add the following unclassified list, only two of which we have seen :—

(90) A papier maché copy of the Wedgwood medallion—of a black color. (C. B.)

(91) A plaster bust of Priestley, cast by Bemis, Birmingham. (C. B.)

(92) William Waite's medallion portrait, exhibited at Birmingham at the Midland Institute, April, 1867.

(93) A locket portrait, exhibited on the same occasion, by Toulmin Smith.

Several valuable collections of portraits, letters, manuscript notes, plates and relics of and concerning Dr. Priestley are in possession of private hands and public depositories. Of these the most notable is that collected and arranged by the late James Yates, F.R.S., and bequeathed by him to the Royal Society. It consists of an elephantine volume of portraits, engravings, letters, newspaper cuttings, etc., and is superbly bound with a Wedgwood medallion and bronze and silver medals inserted in the front cover. I am indebted to the Secretary of the Royal Society, Burlington House, for the privilege of examining this unique collection. Under the title, "Memorials of Dr. Priestley," Mr. Yates described this collection in *The Christian Reformer, or Unitarian Magazine and Review*, New Series, vol. xvi., p. 534; London, 1860. To this article we are indebted for some of the items in the present paper.

From the historical and antiquarian view point, the Timmins Collection, preserved in the Birmingham Reference Library, are more valuable. These two volumes were compiled by Sam : Timmins, Esq., of Birmingham, the well-known

antiquarian and historian. One contains a mass of original documents pertaining to the Riots of Birmingham, including such interesting documents as the ticket to the ill-fated dinner, broadsides and handbills published against the liberal party; portraits, views, and a series of caricatures of Priestley and his friends, too coarse to be amusing. The other volume contains newspaper cuttings, pamphlets, and printed documents relating to the statue erected to Priestley in Birmingham in 1874, by a committee of which Mr. Timmins was chairman. These precious volumes are preserved in the fire-proof vaults of the Birmingham Library.

Relics of a more personal kind are preserved by Swann Hurrell, Esq., of Cambridge, England. These comprise three oval miniatures, in which Priestley's profile appears in white on a blue ground; one measures about 40 mm. in length and has a lock of hair (Priestley's?) set in the back; the other two measure about 55 mm. in length, and the profile is set above pillars and surrounded by ornamental scrolls and wreaths. Mr. Hurrell also treasures two gold rings, one bearing Priestley's profile cut in a red stone; two hair lockets with the monogram S. F. (Sarah Finch); and two Wedgwood medallions, one about  $9\frac{1}{2} \times 7\frac{3}{8}$  inches, and the other smaller. For permission to examine these I am indebted to the courtesy of their owner.

The descendants of Dr. Priestley's granddaughter, the late Mrs. Robert A. Wainewright, *née* Sarah Priestley, and Dr. Priestley's great granddaughter, Mrs. Conyers Button, *née* Jennie Priestley, of Germantown, Pennsylvania, treasure many valuable relics which we shall not further describe. Priestley's descendants residing at Northumberland have also MSS. and souvenirs, but they deposited the large collection of chemical, electrical, and optical apparatus in the National Museum, under charge of the Smithsonian Institution, Washington, D. C.

Finally, we note a rare engraving showing the fury of the mob engaged in sacking Dr. Priestley's house at Birmingham, 1791. The legend reads: "Dr. Priestley's House and Labo-

ratory, Fair Hill, destroyed in the Birmingham Riots, July 14th, 1791. From a picture sketched on the spot in the possession of Joseph Parker." (Publisher's name illegible.) Original painting in possession of Mme. Belloc, London. Of the print we have a photograph made by Dr. L. H. Laudy, of Columbia College, N. Y.

Photograph by Dr. Laudy, of the interior of a room in Northumberland, Pennsylvania; size 20 cm.  $\times$  14.5 cm. On the wall hangs one of Artaud's portraits of Priestley, wreathed in evergreens. On a table in the foreground lie several manuscripts, books, etc., with three bell-jars, which form a small part of the apparatus exhibited at the Centennial of the Discovery of Oxygen in August, 1874, at Northumberland, and now deposited in the Smithsonian Institution.

#### POSTSCRIPT.

We cannot close this imperfect record of tributes to the memory of Dr. Priestley without mention of a monument most recently erected, although it bears no *likeness* of the philosopher whom it honors.

A handsome tablet was dedicated to Joseph Priestley on the 156th anniversary of his birth (Wednesday, March 13th, 1889), at the First Unitarian Church of Philadelphia. The inscription is as follows: "Joseph Priestley, LL.D., F.R.S., Theologian, Philosopher, Scholar. One of the ablest and most eminent exponents of Unitarian Christianity; a leader in scientific research, his life was consecrated to the service of religion; an indefatigable student, an acute observer, a prolific author, a devoted pastor, a wise and influential preacher; in all relations he was pure, simple, upright, humane, courageous. A steadfast defender of the rights of humanity, he was in her early struggle against oppression, a generous friend of America."

And on the left hand side: "Born at Fieldhead in Yorkshire, England, 13 March, 1733. Persecuted for his opinions he emigrated to America, 7 April, 1794. Died at Northumberland in Pennsylvania, 6 February, 1804."

And on the right hand side: "This Church was founded under his encouragement, 12 June, 1796. This monument is erected as a tribute to his memory from the Unitarians of America, 13 March, 1889."

## II. THE LUNAR SOCIETY,

OR

### THE FESTIVE PHILOSOPHERS OF BIRMINGHAM ONE HUNDRED YEARS AGO.

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READ BY H. CARRINGTON BOLTON AT THE FOUNDING OF THE LUNAR SOCIETY OF NEW  
YORK, April 27, 1888.

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THE LUNAR SOCIETY was an informal club or association of scientific men which flourished in Birmingham for nearly forty years. It was founded about the year 1766, by Matthew Boulton, Dr. Erasmus Darwin, Dr. William Small, and their friends; they do not seem to have numbered more than eight or ten at any one time, and they met at each other's houses for dinner every month on the Monday nearest to the full moon, "in order," says Dr. Priestley, "to have the benefit of its light in returning home." Hence the name Lunar Society. The members were accustomed to sit down to dinner at two o'clock, and did not part until eight, exchanging views with each other on topics relating to literature, science, and arts, each contributing his quota of entertainment and instruction.

"We had nothing to do," adds Priestley, "with the *religious* or political principles of each other, we were united by a common love of *Science*, which we thought sufficient to bring together persons of all distinctions, Christians, Jews, Mahometans and Heathens, Monarchist and Republicans."

Each member was allowed to bring with him a friend, and thus many distinguished guests were present at these philosophical banquets. The society occasionally held "meetings extraordinary," in honor of scientific magnates from abroad.



Among the members of the Lunar Society were the following eminent men of science :—

Matthew Boulton, F.R.S. (1728–1809), mechanical engineer and inventor of improvements in the steam-engine. A partner of James Watt.

Dr. Erasmus Darwin, F.R.S. (1731–1802), a physician, poet, and naturalist. Author of the “*Botanic Garden*.”

Dr. William Small (1734–1775), an intimate friend of Darwin, Boulton, and Watt. He was an accomplished physician, chemist, and machinist. He held the professorship of mathematics and natural philosophy in William and Mary College, Virginia, for some years, but returned to England and settled in Birmingham.

Thomas Day (1748–1789), a wealthy, eccentric philanthropist, best known as the author of “*Sandford and Merton*.” A friend of Capt. Keir.

Richard Lovell Edgeworth, F.R.S. (1744–1817), author and philosopher; he contributed papers to the Royal Society. A friend of Day and Darwin.

Dr. William Withering, F.R.S. (1741–1799), physician, botanist, and chemist. He analyzed the mineral witherite named in his honor.

James Watt, F.R.S. (1736–1819), inventor of improvements in the steam-engine, chemist, and engineer. Partner of Boulton.

Captain James Keir (1735–1814), chemist and author; proprietor of several chemical establishments at West Bromwich, near Birmingham. A friend of Darwin and Small.

John Baskerville (1706–1775), inventor of superior type, and publisher of standard works.

Rev. Dr. Joseph Priestley, F.R.S. (1733–1804), the father of pneumatic chemistry, theologian, and philosopher.

William Murdock (1754–1839), mechanical engineer, superintendent of the works of Boulton and Watts. Inventor of the system of lighting by gas, and of many improvements in steam machinery.

Rev. R. A. Johnson, F.R.S., of Kenilworth.

Mr. Samuel Galton, F.R.S., a wealthy man of letters, well skilled in chemistry and natural history.

Mr. Samuel Galton, junior, his son.

Dr. Stoke, a physician of Birmingham.

Among the guests known to have been entertained were the following distinguished men of science and letters :—

Josiah Wedgwood, F.R.S. (1730–1795), the well-known potter and inventor of the ware called by his name.

Sir Joseph Banks, F.R.S. (1743–1820), botanist, President of the Royal Society.

Sir William Herschel, F.R.S. (1738–1822), the most distinguished astronomer of the period.

John Smeaton (1724–1792), civil engineer, builder of Eddystone Lighthouse.

Dr. Samuel Parr (1747–1825), eminent English scholar and critic.

The Rev. Hugh Blair, D.D. (1718–1800), author of “Lectures on Rhetoric.” Professor in the University of Edinburgh.

Adam Afzelius (1750–1836), Swedish botanist. He visited England in 1789.

Dr. Daniel C. Solander, F.R.S. (1736–1782), Swedish Naturalist and physician, Librarian British Museum.

Jean André de Luc (1727–1817), Swiss natural philosopher and geologist.

Dr. Pieter Camper, F.R.S. (1722–1789), Dutch naturalist, and anatomist.

Mr. John Wilkinson, iron-master, brother-in-law to Dr. Priestley.

Mr. William Bewly, a surgeon and apothecary of Norfolk, author of letters on the chemistry of gases. A friend of Dr. Priestley.

Mr. Collins, an American “rebel.”

Dr. Henry Moyes, of Edinburgh, lecturer on chemistry, though blind. He emigrated to America in 1785.

Mr. M. Robinson Boulton, son of Matthew.

The Rev. Joseph Barrington, Roman Catholic priest of

Oscott, a small hamlet, seven or eight miles from Birmingham. Author of several historical works.

Of the original members, two, Small and Baskerville, died in 1775. Dr. Priestley did not become a member until 1780, and Murdock, being so much younger, must have joined still later. Apparently, the society kept no records of its meetings, and but scanty notices of its proceedings can be gathered from the correspondence of its members.

We have given 1766 as the date of the commencement of these social gatherings, but it is probable that they occurred still earlier, for when James Watt visited Soho in 1768 on his way from London to Glasgow, Dr. Small, Dr. Darwin, and Capt. Keir were invited to meet him at "*l'hôtel de l'amitié sur Handsworth Heath*" as Matthew Boulton styled his hospitable mansion. The Society had not perfected its method of conducting affairs as late as 1776, for in this year Boulton wrote to Watt, who had settled in Birmingham :—

"Pray remember that the celebration of the third full moon will be on Saturday, March 3d ; Darwin and Keir will both be at Soho. I then propose to submit my motions to the members respecting new laws and regulations, such as will tend to prevent the decline of a Society which, I hope, will be lasting."

Boulton was of a thoroughly social disposition, and the formation of the Lunar Society was a natural outgrowth of his genial character. He took pleasure in gathering about him in his home persons of kindred tastes and pursuits, in order both to enjoy their friendship and to cultivate his nature by intercourse with minds of the highest pattern. He was a favorite alike with children and philosophers, with noble guests and simple workmen of Cornwall. London had not at that time absorbed to so great a degree the active intelligence of England, especially in the higher departments of science, art, and literature. The men of that period, though busy with their professional duties and domestic cares, were not so wholly engrossed in the turmoil of business which makes life a burden for so many in the present age, and found

time for relaxation in convivial gatherings. In Liverpool Roscoe and Currie were the centres of a social intellectual circle; at Warrington, Aiken, Enfield, and, for a time, Priestley, were the leading spirits of another; at Bristol, Dr. Beddoes and Humphry Davy of a third; and at Norwich, the Taylors and Martineaus of a fourth. In London, Sir Joseph Banks, Dr. Solander, Sir Charles Blagden, Dr. George Fordyce, Drs. Milner, and Maskelyne, Captain Cook, Sir G. Shuckburgh, Lord Mulgrave, John Smeaton, and Jesse Ramsden with Edgeworth and others, met once a week at Jack's Coffee House, and afterwards at Young Slaughter's Coffee House for social converse. This assemblage had no distinctive name. Benjamin Franklin was a frequent attendant, and alludes to it in his correspondence. But the most distinguished gatherings of all were those of the Lunar Society at Birmingham.

The Patriarch of the Society was Dr. Erasmus Darwin, at least until he removed to Derby in 1782. "His fame as a doctor, philosopher, and poet was great throughout the Midland Counties. He was extremely speculative in all directions even in such matters as driving wheel carriages by steam." Being very busy with his medical practice at Lichfield, he was not very regular in his attendance at the dinners of the Society, and excused himself for his absence by such a letter as the following:

APRIL 5th, 1778.

DEAR BOULTON: I am sorry the infernal divinities who visit mankind with diseases, and are therefore at perpetual war with doctors, should have prevented my seeing all your great men at Soho to-day. Lord! what inventions, what wit, what rhetoric, metaphysical, mechanical, and pyrotechnical, will be on the wing, bandied like a shuttlecock from one to another of your troupe of philosophers! while poor I, I by myself I, imprison'd in a post-chaise, am jogg'l'd, and jostl'd, and bump'd, and bruised along the King's highroad to make war upon a stomach-ache or a fever." . . .

[Signed.] ERASMUS DARWIN.

The society evidently served the purpose of a scientific exchange, each member contributing at the monthly meeting results of his own observations, and reporting news from without the circle. Before the establishment of weekly journals of science, this exchange was the natural means of intercommunication, just as the Athenians gathered on Mars Hill "to tell or to hear some new thing" in the political world. The society seems further to have been chosen by persons from a distance as a channel for announcing their own discoveries or those of others to scientists who would appreciate and publish them. James Watt wrote to the Irish chemist Kirwan as follows :—

BIRMINGHAM, NOV. 14, 1783.

DEAR SIR: Your obliging communication of Mr. Scheele's process of making the Prussian acid gave me great pleasure, and, according to your desire, I communicated it to our Lunar Society last Monday, who desire me to return to you their thanks. . . .

JAMES WATT.

When Dr. Priestley dissolved his connection with Lord Shelburne, and removed to Birmingham in 1780, he was warmly welcomed by the members of the Lunar Society as a valuable acquisition. He had corresponded with Boulton, and was already celebrated for his publications and his discoveries in gas chemistry. His discovery of nitric oxide dates from 1772; that of ammonia, hydrochloric acid, and oxygen from 1774; sulphurous acid gas and silicon-tetrafluoride, 1775; and nitrous oxide (laughing gas), 1776. He had published three volumes of his "Experiments and Observations on Air," and was engaged on a fourth. Priestley's love of polemics in metaphysics and theology was reflected in his work in science, and though unassuming and gentle in disposition, his advent infused new vigor into the society, and henceforth gave a chemical turn to the weighty discussions of the feasting philosophers.

In his autobiography, Priestley refers to these meetings in the following language :—

“ I consider my settlement at Birmingham as the happiest event in my life, being highly favorable to every object I had in view, philosophical or theological. In the former respect I had the convenience of good workmen of every kind and the society of persons eminent for their knowledge of chemistry, particularly Mr. Watt, Mr. Keir, and Dr. Withering. These with Mr. Boulton and Dr. Darwin, Mr. Galton, and, afterward, Mr. Johnson, of Kenilworth, and myself, dined together every month, calling ourselves the Lunar Society, because the time of our meeting was the full moon.”

The invitations sent out by the host were not formal, but in the nature of friendly letters, in which hints were given as to the intellectual feast in store. Thus, on January 3d, 1781, Watt wrote to Dr. Darwin: “ I beg that you would impress on your memory the idea that you promised to dine with sundry men of learning at my house on Monday next, and that you will realize the idea. For your encouragement there is a new book to cut up, and it is to be determined whether or not heat is a compound of phlogiston and empyreal air, and whether a mirror can reflect the heat of the fire. I give you a friendly warning that you may be found wanting whichever opinion you adopt in the latter question ; therefore be cautious. If you are meek and humble, perhaps you may be told what light is made of, and also how to make it, and the theory proved both by synthesis and analysis.”

To this communication Dr. Darwin sent the following curious and characteristic answer :—

BEAU DESERT, January 6th, 1781.

DEAR MR. WATT: You know there is a perpetual war carried on between the devil and all holy men. Sometimes one prevails in an odd skirmish or so, and sometimes the other. Now, you must know that this said devil has played me a slippery trick, and, I fear, prevented me from coming to join the holy men at your house, by sending the measles with

peripneumony amongst nine beautiful children of Lord Paget's. For I must suppose it is a work of the devil! Surely the Lord could never think of amusing himself by setting nine innocent little animals to cough their hearts up. Pray, ask your learned Society if this partial evil contributes to any public good, if this pain is necessary to establish the subordination or different links in the chain of animation. If one was to be weaker and less perfect than another, must he therefore have pain as a part of his portion? Pray, inquire of your philosophers, and rescue me from Manichæism.

As to material philosophy, I can tell you some secrets in return for yours, viz., that atmospheric air is composed of light, and the earth of water (and aqueous earth). That water is composed of aqueous gas which is displaced from its earth by oil of vitriol. Pray, make my best devours to all the Phlos., and pray tell Dr. Priestley that I wish he would try whether a plant insulated in  $\text{g}$  will spoil air.

E. DARWIN.

When Darwin removed to Derby, he wrote to the Society:—

"I am here cut off from the milk of science, which flows in such redundant streams from your learned Lunatics, and which, I can assure you, is a very great regret to me."

In another letter he said:—

"I hope philosophy and fire-engines continue to go on well. You heard we sent your Society an air-balloon, which was calculated to have fallen in your garden at Soho, but the wicked wind carried it to Sir Edward Littleton's. Pray, give my compliments to your learned Society."

On another occasion Darwin wrote to Boulton:—

"I hope Behemoth has strength in his loins. Belial and Ashtaroth are two other devils of consequence, and good names for engines of fire."

Judging from these letters, Darwin was certainly a lively associate.

The meetings of the philosophers at Mr. Galton's must have been among the most delightful. The host was a man of

superior intellectual endowments, well skilled in the exact sciences, and a member of the Royal Society and of the Linnean Society. He was of the Quaker persuasion, and a man of family and opulence. He at first resided at The Five Ways about one mile from Birmingham, but in 1785 moved to Great Barr House, a beautiful estate of Sir Joseph Scott, about seven miles further from town. The house was large and rambling, it had four or five different staircases and halls, and was more like an assemblage of several houses under one roof. It was situated in an amphitheatre of wooded hills, and was bordered by an old-fashioned Dutch garden full of fish ponds. In this comfortable mansion the Lunar Society was most hospitably entertained. Mr. Galton's daughter Mary Anne (afterwards Mrs. Schimmel Penninck) characterizes the members with a graceful pen. Mr. Boulton, whom she calls the Father of Birmingham, "was tall and of a noble appearance; his temperament was sanguine, with that slight mixture of phlegmatic which gives calmness and dignity; his manners were eminently open and cordial; he took the lead in conversations, and with a social heart had a *grandiose* manner like that arising from position, wealth, and habitual command. He went among his people like a monarch bestowing largess. His forehead was magnificent; the organs of comparison, constructiveness, and of individuality were immense. The characteristics of Mr. Watt, his partner, were altogether different. Mr. Boulton was a man to rule society with dignity Mr. Watt to lead the contemplative life of a deeply introverted and patiently observant philosopher. He was one of the most complete specimens of the melancholic temperament. His head was generally bent forward or leaning on his hand in meditation; his shoulders stooping, and his chest fallen in; his limbs lank and unmuscular, and his complexion sallow. His intellectual development was magnificent. . . . Whilst Mr. Boulton's eye and countenance had something of radiance, Mr. Watt's were calm, as if patiently investigating or quietly contemplating his object. His utterance was slow and unimpassioned, deep and low in tone, with a broad Scotch accent; his manners gentle,



modest, unassuming. In a company where he was not known, unless spoken to, he might have tranquilly passed the whole time in pursuing his own meditations. But this could not well happen ; for, in point of fact, everybody practically knew the infinite variety of his talents and stores of knowledge. When Mr. Watt entered a room, men of letters, men of science, nay, military men, artists, ladies, even little children thronged around him. I remember a celebrated Swedish artist having been instructed by him that rats' whiskers make the most pliant and elastic painting-brush ; ladies would appeal to him on the best means of devising grates, curing smoking chimneys, warming their houses, and obtaining fast colors. I can speak from experience of his teaching me how to make a dulcimer and improve a Jew's harp." "Quite different was the aspect of Dr. Withering ; he was the personification of that which belongs to a physician and a naturalist ; enormous were his organs of proportion and individuality, and great were his powers of active investigation and accurate detail. His features were sharpened by minute and sagacious observation. He was kind, but his great accuracy and caution rendered his manner less open, and it had neither the wide popularity of Mr. Boulton's, nor the attraction of Mr. Watt's true modesty."

Of Dr. Priestley she says : He was "a man of admirable simplicity, gentleness, and kindness of heart, united with great acuteness of intellect. I can never forget the impression produced on me by the serene expression of his countenance. He, indeed, seemed present with God by recollection and with man by cheerfulness." She differed from Dr. Priestley in his religious views, but pays a handsome tribute to his earnestness, candor, and sincerity.

Captain Keir she characterizes as "the wit, the man of the world, the finished gentleman, who gave life and animation to the party."

Dr. Stoke she calls "profoundly scientific and eminently absent," and relates the following incident in which he was concerned : "On one occasion, when the Lunar Meeting, or 'Lunatics,' as our butler called them, were seated at dinner, a

blazing fire being in the room, we were astonished by hearing a sudden *hissing* noise, and seeing a large and beautiful yellow and black snake rushing about the room. My dear mother, who saw it was not venomous, said to me: 'Mary Anne, go and catch that snake,' which, after some trouble, and thinking all the while of little Harry Sandford and Tommy Merton, I succeeded in accomplishing. We were wondering where it could have come from, when Dr. Stoke said that, as he was riding along, he had seen the poor animal frozen on a bank, and put it in his pocket to dissect, but the snake had thawed and escaped from his pocket. The doctor praised me very much for my prowess, and as a reward he made me a present of my prisoner, which I long kept in a glass jar and carefully tended every day; at last, however, I gave him his freedom."

Of the eccentric Dr. Darwin the lady had less agreeable reminiscences. The doctor had been called professionally to see her mother; he arrived in a worn-out, muddy "sulky," fitted up with receptacles for writing and eating, stocked with sweet confections, of which he was fond, and heaped up with books from the floor to the front window. "We all hastened," she says, "to the window to see Dr. Darwin, of whom we had heard so much, and whom I was prepared to honor and venerate, in no common degree, as the restorer of my mother's health. What, then, was my astonishment at beholding him, as he slowly got out of the carriage! His figure was vast and massive; his head was almost buried on his shoulders, and he wore a scratch-wig, as it is called, tied up in a little bobtail behind." Meanwhile, amidst all this, the doctor's eye was deeply sagacious, his observation most keen, and his intelligence well calculated to inspire confidence in his patients. When conversation began, his flow of wit and anecdote was most entertaining and astonishing, in spite of an inveterate stammering.

Elsewhere she records the painful impression made on her by the doctor's irreligion.<sup>1</sup>

<sup>1</sup> We have ventured to quote, at great length, from Mrs. Schimmel Penninck's graphic reminiscences, because they certainly bear the im-

During the years 1780 to 1785, pneumatic chemistry was the principal topic under discussion, for Priestley and Watt were each contributing his share to the much-vexed question of the constitution of water. Cavendish in London, Lavoisier in Paris, and Watt in Birmingham were three rival claimants for the honor of the discovery of the composition of water. Priestley, as a friend of Watt, communicated speedily the result of his experiments, sometimes it is reasonable to believe, over the festive board of the Lunarians, and left the conclusions to be drawn by others. As to the relative merits of the claimants, that is foreign to the purpose of this essay.

The Priestley-Wedgwood correspondence<sup>1</sup> shows that in 1783 the philosophers were greatly exercised over Priestley's discovery of the conversion of water into air, the fallacy of which he himself afterwards admitted.

The Phlogistic Theory, which had been the controlling spirit in chemical philosophy for nearly a century, received its deathblow at the hands of Priestley himself, when he isolated oxygen on the 1st August, 1774. But he, as is well known, failed to perceive the important bearing of his own discovery, and it was across the channel that Lavoisier and other French chemists were skilfully burying the corpse out of sight. The French theory of combustion was but slowly accepted by the conservative Englishmen, and slowest of all by the friends of Priestley.

In the transition period, hydrogen was for a time believed to be the elusive phlogiston; to this phase of doctrine, Boulton alludes in a letter to Wedgwood dated March 30th, 1781.

"We have long talked of phlogiston without knowing what

press of truth and are lifelike in their portraiture. She had every advantage of forming the acquaintance of the members of the Society, her father being active in it from the time she was eight years old until she was five and twenty, and a tenacious memory, added to a power of discrimination of unusual delicacy, enabled her, in after years, to record her souvenirs. Her mother was a most intimate friend of Mrs. Priestley, and William Priestley was a playmate in her youth. ("Life of Mary Ann Schimmel Penninck," edited by C. C. Hankin. London, 1859.)

<sup>1</sup> See authorities at the close of this paper.

we talked about ; but now that Dr. Priestley hath brought the matter to light, we can pour that element out of one vessel into another, can tell how much of it by accurate measurement is necessary to reduce a calx to a metal, which is easily done, and without putting that calx into contact with any visible thing. In short, this goddess of levity can be measured and weighed like other matter. For the rest, I refer you to the doctor himself."

A few months later, Priestley himself wrote to his friend, Josiah Wedgwood : " Before my late experiments, phlogiston was indeed almost given up by the Lunar Society, but now it seems to be re-established" (March 21st, 1782).

Again Boulton writes to his partner, Watt, July 3d, 1781.

" I dined yesterday at the Lunar Society (Keir's house) ; there was Blair, Priestley, Withering, Galton, and an American " rebel," Mr. Collins. Nothing new, except that some of my white spathos iron ore was found to contain more air than any ore Priestley had ever tried, and what is singular, it contains no common air, but is part fixable and part inflammable."

On September 20th, 1785, Watt wrote to Boulton :—

" The Lunar Society was held yesterday at Mr. Galton's, at Barr. It was rather dull, there having been no philosophical news lately, except Mr. Kirwan's discovery of an air from phosphorus, which takes fire of itself on being mixed with common or dephlogisticated air."

We imagine that the philosophers would have hardly regarded their feast as dull, could Mr. Kirwan have shown to them the beautiful yet nauseating experiment of spontaneously inflammable phosphoretted hydrogen. And a modern Academy of Sciences would be enthusiastic over such a notable discovery.<sup>1</sup>

The discussions of the philosophic *convives* were not, however, confined exclusively to chemistry. The period was one

<sup>1</sup> Gengembre. one of Lavoisier's pupils, had discovered inflammable phosphoretted hydrogen in 1783, but Kirwan's discovery was made independently.

of great activity in the world of science; Laplace was applying his mathematical genius to the problems of astronomy; Herschel was sweeping the heavens with his gigantic telescopes; Galvani and Volta were laying the foundations of a revolution in electricity; Count Rumford in Bavaria, was devoting his great energy to industrial and social economy; Hutton and Werner were geologizing in their respective countries; Haüy was systematizing the innumerable crystalline forms occurring in nature; the Mongolfier brothers were experimenting with air-balloons, and prophesying the yet unsolved problem of aerial navigation; Capt. James Cook returned from his memorable voyages around the world full of adventures and novelties in nature; the application of steam to the driving of land carriages and the propelling of boats was gradually being perfected by patience and genius. These, together with the metaphysical and even the political questions of the day, must have engrossed the attention of the talented friends who dined together at the full moon. The predilections of their guests sometimes determined the character of the subjects discussed. Thus, in the autumn of 1782, the venerable engineer Smeaton, having business in Birmingham connected with his canal, was invited to attend a meeting of the Lunarians at the house of Watt. Watt wrote of this evening's proceedings to his friend Boulton, then in London, as follows:—

“Smeaton grows old and is rather more talkative than he was, but retains in perfection his perspicuity of expression and good sense. He came to the philosophers' meeting at my house on Monday, and we were receiving an account of his experiments on rotatives and some new ones he has made, when unluckily his facts did not agree with Dr. Moyes, the blind philosopher's theories, which made Moyes contradict Smeaton, and brought on a dispute which lost us the information we hoped for, and took away all the pleasure of the meeting, as it lasted two hours without coming half an inch nearer to the point.” (October 26th, 1782.)

Dr. Moyes was a Scotch chemist who had the affliction to be deprived of his sight by smallpox in infancy, yet acquired

an extensive knowledge of natural philosophy and languages, and became a "pleasing philosophical lecturer." His chemical experiments were, of course, performed by an assistant. In a letter dated February 6th, 1783, Priestley introduced Moyes to Sir Joseph Banks in very flattering terms, calling him: "A phenomenon in philosophy, being quite blind, yet superior to most who see."

It has been surmised that the Lunar Society discussed the action of light upon nitrate of silver, and the application of this phenomenon to the production of pictures. This suggestion was made by Mr. W. P. Smith, at a meeting of the Photographic Society of Birmingham in 1863, and was based on the discovery in Mr. Boulton's library at Soho, of certain photographic pictures on metallic plates. It was understood at the time that Boulton's rooms had been closed for fifty years, but this proved to be an error, and the pictures were probably made by a Miss Wilkinson who had access to the rooms, and who had experimented in photography soon after its invention by Niepce. It is well known that Thomas Wedgwood, son of Josiah, is said to have made "silver pictures" under Sir Humphry Davy's eyes as early as 1791-93, hence during the existence of the Lunar Society. A facsimile of one of these early photographs is prefixed to Miss Meteyard's "Life of the Younger Wedgwoods," but she herself throws some doubt on its authenticity.

The philosophical converse of the learned men was sometimes enlivened by humorous interludes, such as the following: Dr. Darwin, whose levity in religious matters was notorious, had invented a speaking machine which pronounced "papa," "mamma," and other words quite accurately. Mr. Boulton, who perhaps had suffered from the caustic wit of the Doctor, drew up the following satirical contract:—

"I promise to pay to Dr. Darwin, of Lichfield, one thousand pounds upon his delivering to me (within two years from date hereof) an instrument called an organ that is capable of pronouncing the Lord's Prayer, the Creed, and Ten Command-

ments in the vulgar tongue, and his ceding to me, and me only, the property of said invention with all the advantages thereunto appertaining."

[Signed.] M. BOULTON.

SOHO, September 3d, 1787.

Witness, JAMES KEIR.

Witness, W. SMALL.

A wide range of topics was admitted in the discussions at the informal meetings. Mrs. Schimmel Penninck, already quoted, gives a vivid picture of an exciting scene in her father's house. It was in the summer of 1788, and Matthew Boulton presented to the company his son M. Robinson Boulton, who had just returned from a long sojourn in Paris. "I well remember," writes Mrs. Schimmel Penninck, "my astonishment at his full dress in the highest adornment of Parisian fashion; but I noticed as a remarkable thing that the company (which consisted of some of the first men in Europe), all with one accord gathered around him and asked innumerable questions, the drift of which I did not fully understand. It was wonderful to me to see Dr. Priestley, Dr. Withering, Mr. Watt, Mr. Boulton himself, and Mr. Keir manifest the most intense interest, each according to his prevailing characteristics, as they almost hung upon his words; and it was impossible to mistake the indications of deep anxiety, hope, fear, curiosity, ardent zeal, or thoughtful gravity, which alternately marked their countenances, as well as those of my own parents. My ears caught the words 'Marie Antoinette,' 'Cardinal de Rohan,' 'diamond necklace,' 'famine,' 'discontent among the people,' 'sullen silence instead of shouts of Vive le Roi!' All present seemed to give a fearful attention. Why, I did not then well know, and in a day or two these things were almost forgotten by me, but the rest of the party heard, no doubt, in the young man's narrative, the distant though as yet faint rising of the storm which a year later was to burst upon France, and in its course to desolate Europe."

It is proper to note that Mary Ann Galton was but eleven

years of age at the time which she describes from memory in her later years.

In 1791 a popular outbreak occurred in Birmingham, which threatened the very existence of the Lunar Society. A riotous mob, led by designing men of the baser sort, took possession, as it were, of the town, and for four days (July 14th to 17th) pillaged and destroyed private property to the value of over one hundred thousand pounds. These July riots have often been described, and details of the fanatical and violent proceedings do not belong to this place. We can but briefly say that the animosity was caused by political bias and religious intolerance, and was especially directed against Dr. Priestley and his friends who had openly expressed their sympathy with the French Revolution, and as Dissenters were known to be opposed to the Established Church. The enraged mob, at first small in number, but increasing to more than a thousand, attacked first a company of eighty gentlemen who were dining together at a public house to commemorate the anniversary of the French Revolution. The mob broke the hotel windows, and shouting "*Church and King*," sought out Dr. Priestley, who had not dined with the company. Not finding him the mob rushed to the "New Meeting House," of which the Rev. Doctor was pastor, and destroyed it by fire. They then sought another Dissenting Chapel, and having levelled it to the ground, marched over a mile to the residence of Dr. Priestley, which was plundered without mercy. His philosophical apparatus was ruthlessly destroyed, and his library and manuscripts scattered to the winds. Dr. Priestley and his family barely escaped with their lives, and never entered the town again. His cheerful temperament and philosophic habit of mind supported him wonderfully, but he never ceased to lament the loss of valuable manuscripts, in which were recorded the results of twenty years of labor and study.

During three succeeding days the mob continued its work of destruction, almost unchecked by the municipal government. They directed their attacks against the property and persons of Dissenters, and of those holding liberal political



views. The houses of the estimable William Hutton, bookseller; of a poor Presbyterian parson, Mr. Hobson; and the more costly mansions of Mr. Humphreys and Mr. William Russell, a particular friend of Dr. Priestley, were pillaged and burned to the ground. The members of the Lunar Society, popularly known as "Lunatics," were the especial object of their hatred and zeal. Shouting "*No philosophers—church and king forever*;" they attacked Edgbaston Hall, the residence of Dr. Withering, but the timely arrival of the light-horse terminated their wretched work of plunder. Some persons, to escape their fury, wrote "No philosophers" on the fronts of their houses. Boulton and Watt were not without apprehension of an attack, and placing arms in the hands of their workmen, addressed them on the criminality of the riotous proceedings, and obtained their promise to defend the establishment. But Soho was spared the dreaded attack, owing to the fact, says Watt, that most of the Dissenters lived in another direction.

As a sequel, some of the ringleaders were executed, and the sufferers were awarded partial compensation for their pecuniary losses. Priestley shook the dust of Birmingham off his feet, fled to London, and some three years later emigrated to the wild regions of the Susquehanna in search of peace.

The first meeting of the Lunar Society, after the frightful riots of July, 1791, must have called for all the philosophy the learned victims could muster. We find several allusions to it. Priestley, in writing to Keir, on the 22d of July (1791), and again on the 29th, from London, expresses the hope that he may be permitted to return to Birmingham before the next Lunar Society, and begs that the meeting be not made to depend upon his arrival. And Mr. Galton, writing to Priestley on Monday, Sept. 5 (1791), expresses pleasure at the prospect of seeing him in Birmingham, and says: "Our Lunar Meeting will be held on Monday, at Barr. Will that influence you to leave London any sooner?" (Correspondence preserved in the Warrington Museum.)

Mr. Samuel Garbett, of Knill Court, Herefordshire, in a

letter to the Marquis of Lansdowne, dated September 24, 1791, gives a few interesting particulars of this meeting, held on the 12th, at Mr. Galton's, which was probably the first one after the riots. He writes: "My accounts from Birmingham do not show that the acrimony subsides. I am told that Dr. Priestley intended to attend the last Lunar meeting, . . . and therefore Mr. Watt, one of the members, went with pistols in his pockets. But Dr. Priestley did not attend the meeting, and I suppose that many of the Presbyterians have beg'd that he may not appear at Birmingham." And in a postscript he adds: "Since writing the other side, I received a letter from Birmingham, in which is the following paragraph: 'Mr. Boulton says he was not at the Lunar Meeting; he said Dr. Priestley is not coming, and complains his friends have not *stuck by him.*'"

Dr. William Withering, the accomplished botanist and physician, eventually abandoned the delusive and favorite doctrine of Phlogiston, so stoutly advocated by Dr. Priestley, and at one of the social meetings of the "Lunatics" read to them a humorous piece in verse entitled: "The Life and Death of Phlogiston" which was long remembered for its clever treatment and pointed wit.

On the 30th March, 1798, Dr. Withering wrote to Sir Joseph Banks, "Mr. Boulton was here Tuesday last; he is up to the elbows in ♀ coinage, but does not talk of visiting London at present. Mr. Watt has sprained and nearly broken the tendo-Achilles of his leg, but in other respects is well. My imperfect health prevents me attending our Lunar meetings in the winter season, but I will not forget as I meet with the parties to express your kind remembrance of them."

Dr. Priestley, while suffering an enforced separation from the society of his fellow-philosophers, was not forgetful of them, and in 1793 he dedicated his treatise, "Experiments on the Generation of Air from Water," to his "valued friends, the members of the Lunar Society at Birmingham." In this dedication, he says: "There are few things I more regret, in consequence of my removal from Birmingham, than the loss

of your society. It both encourages and enlightens me, so that what I did there of a philosophical kind ought in justice to be attributed almost as much to you as to myself. From our cheerful meetings I never absented myself voluntarily, and from my pleasing recollection they will never be absent. Should the cause of our separation make it necessary for me to remove to a still greater distance from you, I shall only think the more, and with the more regret, of our past interviews." "Philosophy," he adds, "engrossed us wholly. Politicians may think there are no objects of any consequence besides those which immediately interest *them*. But objects far superior to any of which they have any idea engaged our attention, and the discussion of them was accompanied with a satisfaction to which they are strangers. Happy would it be for the world if their pursuits were as tranquil, and their projects as innocent and as friendly to the best interests of mankind as ours." Finally, he concludes by earnestly committing them all, though in religious persuasion differing from himself, "to the protection and blessing of that Great Being whose we are, and whom I trust we all serve, and who established that course of nature which is the object of our common investigation." And then the Rev. Doctor prays "with the greatest esteem and affection" for a happy reunion with them all in another state of being.

On another occasion, Priestley, writing to Watt, again expressed his affection for the members of the society in graceful language. After thanking Watt and Boulton for the gift of a copying machine (invented by the former), the Doctor adds: "This and many other things will ever remind me of the obligations I am under to you, and the pleasing intercourse I have had with you and all my friends of the Lunar Society. Such another I can never expect to see. Indeed, London cannot furnish it. I shall always think of you at the usual times of your meeting." (Letter of November 2d, 1791.)

A few days later, Priestley writing from London to Dr. Withering, utters the same sentiments even more at length: "It will be a considerable time, with every assistance that money

can afford, before I can be at work again, and hardly ever to so much advantage as at Birmingham. Such assistance from philosophical friends I should in vain look for here, and as long as I live I shall look back, and with pleasure and regret to our Lunar meetings, which I always enjoyed so much, and from which I derived so much solid advantage. If I could find the same *intelligence* in any club of philosophers here, I could not find the same *frankness*, which is the charm of all society."

In the same letter he adds: "I have lately written to Mr. Watt, and desired him, or the Lunar Society, as a body, to make a proposal to those who act for the county. I hope you will consider the propriety of it, and contribute to its effect. I still hope to have the satisfaction of seeing you and my friends of the Lunar Society some time hence, and always to hear of your proceedings."

Priestley reiterates these cordial sentiments in a letter to Dr. Withering, dated Oct. 2, 1792, wherein he writes: "One of the things I regret the most in being expelled from Birmingham, is the loss of your company and that of the rest of the Lunar Society. I feel I want the spur to constant exertion which I had with you. My philosophical friends here [Clapton] are cold and distant."

And he writes in a similar strain just a year later (Oct. 22, 1793): "I am in a manner cut off from my most agreeable connection with you and the other members of the Lunar Society. Here [Clapton] I hardly see any philosophical persons, except now and then Dr. Crawford . . . I shall send my papers to the Lunar Society."

Even after his settlement in Northumberland, the doctor continued to communicate his scientific observations to his friends in the Lunar Society. On December 6th, 1795, writing to his friend the Rev. Theophilus Lindsey, Priestley explains that he forwards through Dr. Young a copy of a paper prepared for the Philosophical Society at Philadelphia, and says: "Please to forward it to Mr. Galton the first convenient opportunity. It contains several new experiments, which must be

thought of importance, especially with respect to the new French system with which, though universally adopted, I see more and more reason to be dissatisfied." This paper was entitled: "Experiments and Observation Relating to the Analysis of Atmospherical Air; also Further Experiments Relating to the Generation of Air from Water," and was read to the Society February 5, 1796.

About the same time he writes to Dr. Withering: "More than ever do I now regret the loss of the Lunar Society, where I spent so many happy hours, and for which I found no substitute even in London." (Letter of Oct. 27, 1795, from Northumberland.)

Still later, we find evidence that the cordial friendship of Priestley with Boulton and Watt seems to have been unbroken, except as distance prevented personal contact. In 1801, the firm sent Priestley a present of a "noble furnace and other apparatus for making large quantities of air," and the Doctor, in acknowledging the gift, wrote thus: "I send every good wish to yourselves and all the other members of the Lunar Society, the advantages of which I most feelingly find the want of." (Letter of October 17th, 1801.)

The latest reference to the Lunar Society in Priestley's writings is probably that in the introduction to his essay, entitled: "The Doctrine of Phlogiston Established and that of the Composition of Water Refuted," published at Northumberland in 1803. In this he comments on the almost universal acceptance of the new theory of combustion, and says: "And now that Dr. Crawford is dead, I hardly know of any person, except my friends of the Lunar Society of Birmingham, who adhere to the doctrine of phlogiston."

Dr. Priestley is not the only one who records his attachment to this social organization and to its members individually. In his "Memoirs," Richard Lovell Edgeworth writes: Our Society combined "men of very different characters, but all devoted to literature and science. This mutual intimacy has never been broken but by death, nor have any of the number failed to distinguish themselves in science or literature. Some

may think that I ought, with due modesty, to except myself. Mr. Keir, with his knowledge of the world and good sense; Dr. Small, with his benevolence and profound sagacity; Wedgwood,<sup>1</sup> with his increasing industry, experimental variety, and calm investigation; Boulton, with his mobility, quick perception, and bold adventure; Watt, with his strong inventive faculty, undeviating steadiness, and bold resources; Darwin, with his imagination, science, and poetical excellence; and Day, with his unwearied research after truth, his integrity and eloquence—proved altogether such a society as few men have had the good fortune to live with; such an assemblage of friends as fewer still have had the happiness to possess and keep through life.”

As the century drew towards its end, the Lunar Society gradually dissolved, its members dropping off one by one. Priestley had emigrated; Thomas Day was killed by a fall from his horse, in 1789; Dr. Withering died of a lingering consumption, in 1799;<sup>2</sup> Dr. Darwin was carried off by an attack of angina pectoris in 1802; and the ever-welcome guest Josiah Wedgwood passed away in 1795; Capt. Keir, James Watt, and Boulton, the founder, were almost the only members surviving. The vacant seats remained unfilled and the meetings passed into history. The few lingering survivors found its associations too painful to be continued. But the influence exerted by the society did not die; it had stimulated inquiry and quickened the zeal for knowledge of all who had come within its influence, and this spirit diffused and propagated itself in all directions. Leonard Horner, who visited Soho in 1809, thus refers to the continued moral influence of the association: “The remnant of the Lunar Society,” he says, “and the fresh remembrance in others of the remarkable men who composed it, are very interesting. The impression which they made is not yet worn out, but shows itself to the second

<sup>1</sup> Miss Meteyard, the biographer of Wedgwood, says he was not a member of the Lunar Society, but a guest.

<sup>2</sup> During the botanist's long illness, his friends said: “The flower of physic is withering.”

and third generation, in a spirit of scientific curiosity and free inquiry which even yet makes some stand against Toryism and the love of gain." (Smiles.)

Social gatherings of men having kindred intellectual interests and pursuits have many advantages which are lacking in other organizations of a more formal character. Our migratory American Association has marked social aspects, but it brings together workers in science only once a year, and its chief social advantages result from the acquaintances formed between the entertaining citizens and their scientific guests. Our New York Academy of Sciences, with its noble history, occupies a field of its own, and is the proper place for announcing discoveries in every department of learning, but the parliamentary forms necessary to dignified proceedings forbid or hamper the freest interchange of opinions and the formation of those personal friendships which a social organization like the Lunar Society so admirably fosters.

One of the members of the Lunar Society, Richard Lovell Edgeworth, perceived this difference between the two classes of associations, and states the case in well chosen words. Alluding to the Lunar Society in his "Memoirs," he writes:

"A society of literary men and a literary society may be very different. In the one, men give the results of their serious researches and detail their deliberate thoughts; in the other, the first hints of discoveries, the current observations, and the mutual collision of ideas are of important utility. The knowledge of each member of such a society becomes in time disseminated among the whole body, and a certain *esprit du corps*, uncontaminated with jealousy, in some degree combines the talents of members to forward the views of a single person."

It is with such thoughts as these that I have ventured to call together this distinguished company, and to propose the perpetuation of the memory of the historic society of Birmingham by founding in the metropolis of the New World another Lunar Society having similar aims and methods.

The original organization has long passed into history ; but will not the meetings on this side of the Atlantic be enlightened by the same moon that shone on the festive philosophers of Birmingham ?

In preparing this sketch we have made free use of the following works :—

- Muirhead's "Life of James Watt," London, 1858.  
 Muirhead's "Mechanical Inventions of Watt," London, 1854.  
 Smiles' "Lives of Boulton and Watt," London, 1864.  
 Krause's "Erasmus Darwin," London, 1879.  
 Edgeworth's "Memoirs," London, 1820, 2 vols.  
 Brougham's "Philosophers of the Time of George III.," London, 1855.  
 Rutt's "Life and Correspondence of Priestley," London, 1832. 2 vols.  
 Jewett's "Life of William Hutton," London, n. d.  
 "Life of Mary Ann Schimmel Penninck," by herself, London, 1859.  
 Meteyard's "Life of Wedgwood," London, 1865. 2 vols.  
 Meteyard's "Group of Englishmen," London, 1871.  
 J. A. Langford's "Century of Birmingham Life," Birmingham, 1868.  
 8vo., 2 vols.  
 Robert K. Dent's "Old and New Birmingham," Birmingham, 1879–80. 3 vols., 4to.  
 (J. Keir Moilliet.) "Sketch of the Life of James Keir," London, n. d. (1868.) 8vo.  
 Edouard Grimaux's "Lavoisier d'après sa correspondance," Paris, 1888. 8vo.  
 (W. Withering.) "The Miscellaneous Tracts of Wm. Withering with a Memoir of his Life, Character, and Writings," London, 1822. 2 vols., 8vo.  
 Muirhead's "Discovery of the Composition of Water," London, 1850. 8vo.  
 As well as of the letters in this volume.



"THE religious tenets of DR. PRIESTLEY appear to me erroneous in the extreme ; but I should be sorry to suffer any difference of opinion to diminish my sensibility to virtue, or my admiration of genius. His enlightened and active mind, his unwearied assiduity, the extent of his researches, the light he has poured into almost every department of science, will be the admiration of that period when the greater part of those who have praised, and those who have blamed him, will be alike forgotten."

ROBERT HALL.

"LET DR. PRIESTLEY be confuted where he is mistaken ; let him be exposed where he is superficial ; let him be repressed where he is dogmatical ; let him be rebuked where he is censorious. But let not his attainments be depreciated, because they are numerous, almost without parallel. Let not his talents be ridiculed, because they are superlatively great. Let not his morals be vilified, because they are correct without austerity, and exemplary without ostentation ; because they present, even to common observers, the innocence of a hermit, and the simplicity of a patriarch ; and because a philosophic eye will at once discover in them the deep-fixed root of virtuous principle, and the solid trunk of virtuous habit."

SAMUEL PARR, D.D.

### III. INVENTORY OF DR. PRIESTLEY'S LABORATORY, 1791.

FROM THE "BIRMINGHAM WEEKLY POST," March 15, 22, 29, and April 5, 1890, AND  
REPRINTED BY PERMISSION OF SAM: TIMMINS, ESQ., F.S.A.

#### DR. PRIESTLEY'S LABORATORY IN 1791.

THE courtesy of a friend has allowed me to have a copy made of a unique document, an official Inventory of the Household Goods, Books, Pictures, and Laboratory at Fairhill, Stratford Road, Birmingham, which were damaged or destroyed by the Rioters in 1791. The document is a folio book, with 65 pages, in which the most minute details are given and the value of each entry is given by sworn valuers, surveyors for the buildings, auctioneers for the furniture, and booksellers for the books, &c., &c. All these are very curious and interesting as records of the interior of a substantial house a hundred years ago, and valuable as a register of the prices of household furniture. The record is, perhaps, too minute to be reprinted at full length and in full detail, but the accounts of the Laboratory, Philosophical Apparatus, &c., are well worth preserving as a record of the means at the command of a famous chemist and philosopher whose name and discoveries have secured him the highest honours in the world of science for more than one hundred years.

The Catalogue of Books in the Library has also much interest, but it will, probably, suffice to limit this account to the various rooms in which Philosophical Apparatus was placed. Many of the items have singular interest, and some of them, probably, require some explanation or deserve some comment from the experts in science who may read this record.

ESTE.

#### *Library.*

A Mahogany Bureau . . . . .	£4 14 6
An Oak Writing Table and Drawer . . . . .	1 1 0
A Grate Fender Tongs and Fire Irons . . . . .	1 5 0
Six Mahogany Chairs and an Arm ditto covered with Leather . . . . .	7 5 0

*Library.*

A Magellan Time Piece . . . . .	£3	3	0
A Boulton and Watts Copying Machine compleat . . . . .	7	7	0
A strong Deal Table to Ditto 4 feet by three and shelf the whole length with two drawers . . . . .	1	10	0
A large Deal Chest with folding Doors Shelves Locks Bolts and Keys . . . . .	3	3	0
A Deal Table 4 feet by 2 feet 6 with a Shelf the whole length and Shelf for Papers . . . . .	0	8	0
A large Roll up Screen to receive Images for a Solar Microscope and roller to roll ditto . . . . .	2	2	0
The Window Shutters to darken the Room for the above purpose Bolts and Fastnings . . . . .	0	15	0
Three Wedgwood black Inkstands and 2 Glass Inkstands . . . . .	0	6	6
Eight Shelves the whole length of the Library 21 feet long and $\frac{3}{4}$ inch thick and Uprights to Ditto making a nest of Book Shelves . . . . .	4	10	0
The side where the Door went in full of Shelves 9 ft. by 16 feet . . . . .	2	10	0
Fire place side filled with Shelves same as Door side . . . . .	1	11	6
A large Shelf over Windows and Brackets and End pieces . . . . .	0	7	0
A large Ditto . . . . .	0	6	0
A small nest of Shelves for small Books and 2 small Pidgeon holes for Papers . . . . .	1	13	0
Money in the Bureau 5 guineas . . . . .	5	5	0
A large Silver Medallion of Sir Isaac Newton . . . . .	2	2	0
Two five Guinea Notes in pocket Books . . . . .	10	10	0
Wedgwood large Medallion of Newton Oval Ebony frame . . . . .	1	1	0
Two Medallions unframed and 2 small ditto of Dr. Franklin . . . . .	2	12	6
The Head of Sir George Saville . . . . .	0	10	6
The Head of Dr. Franklin Mezzitinto . . . . .	0	10	6
A View of new Colledge Hackney . . . . .	0	7	6
A View of the Meeting and Dwelling House at Nantwich . . . . .	0	7	0
A Steel pen in a Silver Case a Ditto Silver Case and Metal pen . . . . .	0	10	0
About a Ream of Foolscap paper . . . . .	1	5	0
A Ream of Quarto Letter paper . . . . .	1	0	0
About a Ream of Copying paper . . . . .	0	18	0
A Quire of Cambric paper for the Machine . . . . .	0	1	6
Eleven papers of Ink powder . . . . .	0	11	0
A Set of Tools for cleaning pistols and Gun steel . . . . .	0	10	6
Shelves in passage one 16 feet long on bracketts three Ditto 12 feet long and one 3 feet long all for Books . . . . .	1	5	0
Shelves in the Boys Room for Books—7 Shelves 9 feet long and three Ditto uprights one Ditto 12 feet long nine Ditto six feet Ditto and one Upright and two Shelves 6 feet long . . . . .	3	11	6

*Closet.*

One Shelf 8 feet long inch thick and 12 broad and two Ditto  
6 feet long and 4 feet broad . . . . . £0 18 0

*Shelves in the Elaboratory.*

Three Shelves eighteen feet long twelve inches broad and  
upright between . . . . . 1 10 0  
Three Shelves twelve feet long with three Supports two 12  
feet long and 9 inch broad . . . . . 1 8 0  
Six Ditto 13 feet long one 10 feet and 10 Ditto three feet  
narrow . . . . . 2 0 0  
A long part for Retorts two Boards with pegs for phials 2 two  
pillars for Ditto . . . . . 1 4 0

*Above Stairs in the Elaboratory.*

Two Shelves 12 feet 12 inches broad three Ditto 12 feet  
narrow Five Ditto 12 feet long with Upright Ends from  
Floor with Ledges on Ditto . . . . . 1 8 6  
One Shelf 16 feet long four shelves 12 feet long supported  
from Floor and one upright to divide . . . . . 1 1 0  
Two ditto 12 feet long one Do. 4 feet and two one Ditto 2  
feet long . . . . . 0 12 0  
One Shelf 8 feet long 4 feet and two three feet long on Stairs  
a painted Shelf eight feet long at Outside of the house . . 0 12 0  
Shelves in the Shed two Shelves and the fitting up of the  
Coal Hole fitted up compleat with Sliding Boards in front . 1 10 0

*In the Elaboratory.*

A large Oak Bureau Desk . . . . . 2 12 6  
A strong Deal Table six feet by  $3\frac{1}{2}$  and 2 shelves through the  
whole divided by partitions . . . . . 2 2 0  
A Ditto Table 3 ft. by 2 ft. with a Shelf under ditto . . . 0 12 0  
A Ditto Table 4 feet by 2 with Shelf to go into partitions  
under Ditto . . . . . 1 0 0  
A strong Deal Table 4 feet by  $3\frac{1}{2}$  with two Drawers . . . . 1 1 0  
Three wooden Bottom Chairs . . . . . 0 9 0  
Twenty-four Boxes different sizes . . . . . 1 16 0  
A Franklin Stove and Fire Irons . . . . . 4 4 0  
A large Oak Table painted to try Experiments in the Sun . . 0 10 6  
A large Smiths forge Bellows fixt to a strong Deal Table . . 3 10 0  
A large pair of Hand double Bellows . . . . . 1 10 0  
A large Double Bellows with compleat Apparatus for melting  
Glass and a large Table . . . . . 4 4 0  
A small Ditto neatly made under a smaller Ditto Table . . 1 10 0

A large Trough of Inch Deals about three feet long 12 inches wide and 12 deep with a strong Shelf in Ditto cut into Funnels . . . . .	£1	1	0
An Apparatus to support a Glass Funnel within the Water . . . . .	0	5	0
A Wooden pillar made to suspend Vessels in and over the Water . . . . .	0	2	6
A Trough 2 feet Deep with Shelf as above . . . . .	1	1	0
A large Trough 8 feet long 9 inches deep made to hold Water . . . . .	0	18	0
Two Water Troughs 18 in. long 12 inches deep and 12 wide . . . . .	1	1	0
Two 15 by 12 as above . . . . .	0	15	0
A Worm Tub with pewter Worm and pewter Tubes . . . . .	0	12	0
A Copper Still fitted to Worm Tub . . . . .	2	2	0
A small Worm Tub with Glass Worms . . . . .	1	1	0
A japan'd watch makers San pan with a Shade . . . . .	1	1	0
A Mahogany pillar with Candlesticks to slide up and down . . . . .	0	14	0
A patent Lamp to light a passage . . . . .	0	5	0
Strong Lock and Keys and Iron Barrs to all the Windows and Bars to Doors . . . . .	8	0	0
A Mahogany Vessel to hold 70lb. mercury with an upright piece to support tubes and a wooden Trough for it to stand in . . . . .	2	12	6
Twelve white Basons to hold Mercury 5 doz. Ditto small Cups and dishes . . . . .	2	3	0
Twelve large white ware Dishes various sizes . . . . .	0	18	0
Eighteen earthen Vessels round 6in. diameter and 4 deep . . . . .	0	9	0
Six large Stone brown Jars with 2 large stone bottles with Handles . . . . .	1	3	0
A small Anvill with four hammers and a large Iron Shovel and two small ditto Stands . . . . .	0	18	6
A compleat Chest of Carpenters Tools . . . . .	4	4	0
A large Mahogany Lathe for turning Wood Iron and Brass with Tools compleat . . . . .	12	12	0
A Carpenters large Work Bench with Vice fixt and hand cutting fixt to Ditto . . . . .	2	2	0
Two hand Vices . . . . .	0	8	0
A small Bench Vice . . . . .	0	7	6
About 12 Doz. Corks . . . . .	0	10	0
A Chest of small Drawers in 2 parts full of drawers stained Wood . . . . .	2	2	0
A Copper Vessel 12in. deep and 8 wide with a handle . . . . .	0	10	6
A Ditto 8in. deep and six wide close at Top and a spout . . . . .	0	10	6
Twelve Gun Barrels . . . . .	1	14	0
A Copper Vessel the same bore as the Gun Barrels . . . . .	0	12	0
A Cast Iron Tube four feet long and 1½ dia. . . . .	0	5	0
Two large Iron Tubes 4in. Bore . . . . .	1	1	0

An Iron Vessel made to steam light . . . . .	£1 5 0
Twelve doz. phials . . . . .	0 12 0
Three wooden frames for Distillation . . . . .	0 12 0
Three doz. of large black earthen Vessels holding from 3 Galls. to 1 Gall. . . . .	0 18 0
Two doz. of a small size holding from one Gall. to a pint . . . . .	0 12 0

*Miscellaneous Articles.*

A Firing Iron sundry Toys and pressing Screw three Quar- ters Hundred best Quills . . . . .	1 10 0
An Oak Box with partitions neatly made . . . . .	0 10 0
A large Mahogany Drawing Board with a jointed T Square . . . . .	1 8 0
Two Slates filed brass Slides to write in Dark . . . . .	0 5 0

*Fifth*, a Schedule Inventory and Appraisement of the Philosophical Instruments, Electrical Apparatus, Optical Instruments, Mathematical Instruments, Chymical Apparatus and Chymical substances belonging to the said Plaintiff being in and about his said Dwelling House and Out-houses and being wholly or in part destroyed and demolished by the Rioters, vizt. :—

*Philosophical Instruments.*

Two Vessels of tin'd Iron painted eight inches diameter to catch and measure the Rain one of them furnished with a Glass Tube one inch in diameter . . . . .	1 1 0
A Brass Dial eight inches in diameter and a wooden pillar . . . . .	1 1 0
Two Thermometers of Mr. Cavendish's construction for measuring Heat and Cold in any Interval . . . . .	1 4 0
Another Ditto of Mr. Six's construction . . . . .	2 2 0
One ditto of Mr. Nairne's in a Shagreen case . . . . .	1 1 0
Another Ditto of a similar construction with a Brass Scale . . . . .	1 1 0
Two Do. accurately divided into tenths of Degrees . . . . .	6 6 0
About a dozen ditto without Divisions . . . . .	1 16 0
Four Ditto for Measuring great Degrees of Heat and Colds with Divisions and numbers cut on the Tubes . . . . .	12 12 0
A Barometer and Thermometer in a neat Mahogany frame . . . . .	2 12 6
Double Barometer with Mercury and Spirits . . . . .	0 12 0
Ditto with a seal of three feet in length . . . . .	0 12 0
Do. constructed in the manner of Mr. Six's Thermometer the Height of the Mercury in a persons absence . . . . .	3 3 0
Mr. Wedgwoods Thermometer with a complete set of Fire pieces in a Mahogany Box and another separate Scale on Wood . . . . .	3 0 0
Four large Vessels for Dr. Crawfords' Experiments on Heat . . . . .	0 14 0
An Oslipite with two necks . . . . .	1 5 0

Every thing belonging to an Air Gun except the Barrel Stock and Syringe . . . . .	£3	3	0
Mr. Seaton's Air Pump and Condenser . . . . .	36	15	0
Mr. Martin's Table Air Pump of the smallest size . . . . .	2	12	6
A very extensive Apparatus for Experiments on the Air Pump including two Brass Transferrors and two of Glass by Mr. Parker . . . . .	30	0	0
A very large Condensing Machine by Mr. Nairne with a Syringe and two additional strong Glass Vessels of a smaller size with Brass Stands . . . . .	10	18	0
A copper Vessel and Fountain by condensed Air with a Brass Syringe adapted to it . . . . .	3	13	6
A Papins Digester by Mr. Nairne with a Furnace adapted to it and another by Nairne with double Iron vessels . . . . .	9	4	0
Mr. Cantons Set of Magnets of the best sort by Mr. Nairne . . . . .	1	16	0
A Sett of Large Horse Shoe Magnets which would lift more than a Hundred Weight . . . . .	3	14	6
A pair of Magnets about nine inches long . . . . .	0	6	0
An apparatus to shew the Dipping property of the Magnet by Mr. Adams . . . . .	0	18	0
A Twisted Glass Tube with Bulbs at each end and set in a Frame to shew the Specific Gravity of differently coloured Liquors . . . . .	0	8	0
A large Water Hammer . . . . .	0	2	6
Two Pulse Glasses with Deal Cases . . . . .	0	5	0
A pair of twelve inch Globes with the latest discoveries . . . . .	3	6	0
An Orrery of Mr. Martins Plan shewing the Motion of all the Primary Planets with a double set of stems to support the Planets . . . . .	10	10	0
A Wooden Globe one foot in diameter to represent the Sun and Wood or Ivory Balls in proportion to it to represent the Planets in order to be placed on stands at proper distances in a large Field . . . . .	1	1	0
An Hygrometer of Mr. De Lucs . . . . .	2	2	0
Amount of Philosophical Instruments . . . . .	160	16	6

*Electrical Aparatus.*

An Electrical Machine on the largest construction by Mr. Nairne the Cylinder 13 inches in diameter with various Apparatus . . . . .	25	4	0
An additional Prime Conductor fifteen feet long and eighteen inches in diameter with two Glass Rods each an inch in diameter and four feet long, fixed in Mahogany Claws a Brass Cylinder to slide into it eighteen inches long and one in diameter with three Brass Balls one of them six inches in diameter another four and another three . . . . .	16	16	0

Mr. Nairnes Medical Electrical Machine with its complete Apparatus and an additional Cylinder . . . . .	£18	2	6
Mr. Cuthbertsons Machine with two Plates Eighteen inches in diameter a neat Mahogany Box to contain it and its Apparatus and an additional one of Deal for common Use . . . . .	18	0	0
A large Electrical Machine for the Table of my own construction described in my History of Electricity . . . . .	7	7	0
A small Electrical Machine with a Wheel and a Box to contain it to be used in Experiments on Air . . . . .	1	1	0
Three Globes about ten inches in diameter fitted to turn in a Lathe the Rubber insulated with a Glass plate and a small prime Conductor . . . . .	2	5	0
A Coated Jar of the largest size with a Box stuffed on the inside to contain it . . . . .	2	5	0
Another Coated Jar nearly as large and though cracked by an explosion yet of consibl. use . . . . .	0	5	0
Another Jar about half the size entire and properly filled up . . . . .	1	1	0
A Battery consisting of thirty-six Jars each eighteen inches by four . . . . .	16	16	0
Another of twenty five square feet of Coated Glass the Jar of a smaller size . . . . .	7	7	0
Another of four Jars eighteen inches by four . . . . .	2	2	0
About forty square feet of coated Jars which had been cracked by Explosions but were of some use . . . . .	2	10	0
An Electrophorus nine inches in diameter with a Marble plate of the same size for a Condenser . . . . .	1	1	0
Another of about six inches in diameter by Mr. Nairne in a neat shagreen case . . . . .	0	15	0
Mr. Bonnet's Electrometer with a Marble Condenser adapted to it . . . . .	0	18	0
Mr. Nicholson's revolving doubler . . . . .	3	3	0
Dr. Heberden's fine Tourmalin described in the Philosophical Transactions for which he gave . . . . .	9	9	0
Two of Mr. Henley's Electrometers one in Ivory and the other in Wood by Mr. Nairne . . . . .	0	15	0
Mr. Lane's Electrometer with a Mahogany Stand . . . . .	0	3	6
Three of Mr. Canton's Electrometers in Mahogany Cases . . . . .	0	7	6
Two dozen of Brass Balls from two inches to half an inch in diameter and one dozen of Iron Balls turned in a Lathe one inch in diameter . . . . .	1	16	0
Twelve brass Rods of different Lengths with screws to fasten them to . . . . .	0	6	0
A prime Conductor of Copper four feet long and four inches in diameter terminating in a Ball of six inches . . . . .	1	11	6



A tinned Iron Conductor seven or eight feet long and six inches diameter made to divide into two . . . . .	£1	1	0
A round inch Deal Board three feet diameter coated with Tinfoil and furnished with Silken Strings in order to be suspended over a Mahogany Table of the same size . . . . .	0	10	0
A fine round piece of Amber eight small Tourmalins a Brazilian Topaz and six dozen Pith and Cork Balls of various sizes . . . . .	2	3	6
Four pounds of Tinfoil . . . . .	0	8	0
Ten yards of Brass and Iron Chain of different sizes . . . . .	0	10	0
A Glass Globe ten inches in diameter with an Apparatus for exhausting it three Glass Tubes between three and four feet long prepared in the same manner and other Tubes exhausted and hermetically sealed to shew the electric Light in vacuo . . . . .	1	11	6
A large double Vacometer for the same purpose . . . . .	0	10	0
Two Stools with Glass Feet . . . . .	0	15	0
An Inflammable Air Pistol . . . . .	0	7	6
Amount of Electrical Apparatus . . . . .	£144	3	6

*Optical Instruments.*

Six prisms of the best kind . . . . .	£6	6	0
Two Mahogany Stands in order to place them in all directions comprized and made by Mr. Ramsden . . . . .	1	12	0
A Refracting Telescope fourteen feet Focus with wooden Sliding Tubes and a Set of Lenses for Day Objects . . . . .	1	11	6
A Telescope eight feet Focus with Paste board Tubes . . . . .	0	12	0
Two Telescopes magnifying about ten times one in a Mahogany Tube and the others in sliding Tubes and a shagreen case . . . . .	0	14	0
Another Achromatic with Sliding Tubes about two feet when drawn out . . . . .	1	11	6
Solar Microscope in brass fitted also for opaque objects with a small achromatic Telescope and a complete Wilson's . . . . .	7	7	0
Solar Microscope in Wood . . . . .	1	11	6
Nairn's Aquatic Microscope with an Addition to make it compound . . . . .	8	13	6
A Wilson's Microscope in a Mahogany Box with several additional Lenses by Mr. Dollond . . . . .	2	12	6
About three dozen of Sliders with objects including one Dozen of fine sections of Wood . . . . .	2	2	0
Six figures in Anamorphosis with a Cylindrical Mirror . . . . .	2	2	0
A Burning Lense twelve inches in diameter with a Wooden Stand . . . . .	6	6	0

Ditto seven inches diameter without a Stand . . . . .	£3	3	0
Ditto five inches diameter with a Handle and Mahogany frame . . . . .		0	10 6
Ditto three inches diameter in a Horn frame . . . . .		0	4 6
Ditto three small Lenses in a frame of Horn . . . . .		0	5 0
Three small Lenses in single Frames . . . . .		0	4 6
A set of Lenses in frames to move on a stand in order to ex- plain the Structure of Telescopes . . . . .		0	18 0
About half a dozen smaller Lenses of different Focus's . . . . .		0	6 0
A pair of Temple Spectacles . . . . .		0	5 0
Ditto of Green Glass . . . . .		0	6 0
Ditto with two sets of opaque Glasses for viewing Luminous Objects . . . . .		0	8 0
A large Magic Lanthorn . . . . .		1	5 0
Three Slides of figures remarkably well done . . . . .		2	4 0
Twelve such as are now commonly sold . . . . .		3	3 0
A Camera Obscura in the form of a very large Book . . . . .		5	5 0
Two dozen Landskips and Views coloured . . . . .		1	16 0
One dozen ditto not colored . . . . .		0	18 0
A Glass Globe 7 inches diameter silvered on the inside . . . . .		0	5 0
Three small Microscopes with single Lenses in Glass frames . . . . .		0	3 0
Amount of Optical Instruments . . . . .	£59	11	0

*Mathematical Instruments.*

A Perambulator . . . . .	5	5	0
A Theodolite by Wright . . . . .	5	5	0
A curious Brass Scale by ditto . . . . .	0	12	0
A Plain Table and a large brass Scale with sights . . . . .	4	4	0
A cross Staff with Sights . . . . .	0	7	6
A Gunter's chain . . . . .	0	7	6
A Pocket case of Instruments . . . . .	0	13	6
Three pair of brass Compasses . . . . .	1	4	0
A one foot Box Rule . . . . .	0	1	6
A one foot Box Sector . . . . .	0	18	0
A Sliding Rule of the best construction . . . . .	0	5	0
A Navigation Sliding Rule . . . . .	0	3	6
An Ebony Parallel Ruler one Foot in length . . . . .	0	7	6
Tin Case of small Tools . . . . .	1	6	0
Two sets of Beams and Scales by Mr. Whitehurst to weigh about one pound each . . . . .	6	6	0
A pair of very fine Assaye Scales in a large Glass fframe . . . . .	7	7	0
A Scale Beam about three feet long with Scales and weights four of them Iron ten pounds weight neatly turned . . . . .	4	4	0
Mr. Nairne's Hydrostatic balance . . . . .	4	4	0

Martin's ditto . . . . .	£0 12 0
A set of Troy and another of Averdupoise weight each one pound with their Subdivisions . . . . .	1 11 0
Three sets of Penny Weights and Grains . . . . .	0 4 6
A Set of Sub-divisions of a Grain by Mr. Whitehurst . . . . .	1 1 0
A set of Grain Weights divided decimally and a Mahogany Case for small Weights . . . . .	0 10 6
Ellicott's pyrometer . . . . .	5 5 0
Two Quadrants of Wood . . . . .	0 18 0
Ferguson's Magic Circle in Horn and Box Wood . . . . .	0 10 6
Amount of Mathematical Instruments . . . . .	<u>£55 13 6</u>

*Chymical Apparatus.*

A Furnace of Dr. Black's Construction made of Iron and lined with Fire Brick . . . . .	3 13 6
A sand Heat of Cast Iron three feet in length and one in the other Dimensions with an Apparatus curiously constructed by Dr. Withering for admitting more or less air . . . . .	6 0 0
Mr. Parker's furnace and apparatus for distilling with many small Retorts containing a large Copper Vessel also Iron Tubes twelve feet long and four in diameter adapted to it in order to warm the Laboratory and an additional Iron Grate to go over the Fire . . . . .	8 8 0
A Brick Air Furnace for great Degrees of Heat . . . . .	1 11 6
Two Furnaces made by Mr. Wolfe for the largest Crucibles . . . . .	2 2 0
Another ditto with an Apparatus for distilling and Copper Tubes to encrease the Heat by Mr. Warltire inclosed in a Copper Case . . . . .	1 11 6
Two small Iron furnaces . . . . .	0 7 6
Two Cylindrical Iron Vessels with Grates about seven inches diameter . . . . .	0 10 0
Two Iron Grates about sixteen inches long and eight wide for temporary Furnaces with loose Bricks . . . . .	0 12 0
Mr. Argand's Lamp on a Stand with an Apparatus for distilling Another adapted to a tin Vessel containing about a Quart of Oil . . . . .	0 12 0
Landriani's Eudiometer with Glass Cocks sent from Italy . . . . .	1 1 0
Fontana's ditto . . . . .	1 1 0
Another of my Own Construction with two addition Glass Tubes and the Figures cut on them with a File by Dr. Falconer . . . . .	1 11 6
A Set of Glass Measures from a pint to an ounce of water . . . . .	0 12 0
A strong Glass Tube three feet long and one Inch and half in diameter fitted with brass Caps for explosions with Air . . . . .	1 1 0

Four Glass Tubes one inch in diameter from twelve to eighteen inches in length fitted in the same manner . . .	£1 12 0
A similar One Copper . . . . .	0 5 0
Another in Glass to be filled with Mercury and then with Air fitted with strong screws for explosions . . . . .	0 7 6
About thirty Glass Retorts containing from two quarts to one some of them tubulated . . . . .	9 0 0
About four dozen ditto of a smaller size holding from one pint to half a pint . . . . .	2 8 0
About three dozen small ditto holding about an ounce of water . . . . .	1 7 0
About two dozen thin Glass Vessels six or eight inches in height and two in diameter for Experiments on the Air in the Sun . . . . .	1 4 0
About two dozen Glass Phials with Tubes ground to them the largest holding more than a quart and the smallest about an ounce of water . . . . .	4 16 0
About 8 dozen Phials with ground Stoppers holding from two or three quarts to half an ounce of water . . . . .	6 0 0
About sixteen dozen of Phials with ground Stoppers . . . . .	0 16 0
About three dozen of Glass Jars ten or twelve inches in height and two in diameter for Experiments on Air . . . . .	1 16 0
About two dozen of smaller sizes . . . . .	1 10 0
About eighteen Jars ten inches in length and three in diameter . . . . .	2 5 0
Six Jars eighteen inches in length and four in diameter . . . . .	1 10 0
Six large Glass Shades for Lamps . . . . .	0 18 0
Three Conical Vessels eight inches in diameter and six in height ground for Receivers to an Air Pump . . . . .	0 6 0
Three Conical Vessels twelve in height and six width . . . . .	0 9 0
Mr. Parker's Apparatus for impregnating Water with fixed Air of the last construction . . . . .	1 10 0
Another wanting the lower Vessel . . . . .	1 2 6
Another of small Size complete . . . . .	1 1 0
Three dozen Glass Tubes three feet long three of them an inch in diameter with Ground Stoppers . . . . .	4 17 6
About six dozen smaller flint Glass Tubes from three to four feet long and various small diameters . . . . .	4 10 0
About four dozen Green Glass Tubes ditto . . . . .	3 0 0
About three dozen Glass Tubes wide and closed at one end and drawn to a point at the other from two to three feet in length . . . . .	5 8 0
A Glass Tube three feet long and one inch in diameter with a Bulb at the End hold two quarts of water . . . . .	0 12 0
Three Barometer Tubes with Bulbs holding about a pint . . . . .	1 11 6

Six Cases of Iron and Brass wire to support Retorts in distillation . . . . .	£0 15 0
Five cast Iron Retorts with Sand . . . . .	0 3 0
A great Variety of small Tools for cutting &c. bending wire &c. . . . .	0 10 6
Three brass blow pipes and several Glass ones . . . . .	0 7 6
About a dozen files . . . . .	0 5 0
Nail Pincers and various small Tools . . . . .	0 5 0
Half a dozen forceps and other Instruments to manage fires . . . . .	1 10 0
A Tin'd Iron Vessel with Cover ten inches in length six wide and six deep for a Sand Heat . . . . .	0 10 0
About a dozen other tin'd Vessels with Covers to hold different substances . . . . .	0 8 0
About Eighty pounds of Mercury . . . . .	20 0 0
About three dozen Glass Vessels an inch or half an inch in diameter and ten or twelve inches long to confine different kinds of Air by Mercury . . . . .	2 5 0
Dr. Crawford's Apparatus for ascertaining the specific heat of different kinds of Air by Mr. Nairne . . . . .	5 5 0
Half a dozen large black Crucibles . . . . .	0 18 0
A dozen large White ditto and two dozen Nests of small Hessian Ones . . . . .	0 8 0
The Apparatus to a Lens sixteen inches in diameter by Mr. Parker . . . . .	7 7 0
Amount of Chymical Apparatus . . . . .	£133 10 0

*Chymical Substances.*

Terra Ponderosa aerated half cwt. . . . .	£3 3 0
Cwt. of Manganese most of it finely powder'd and cleaned . . . . .	1 1 0
One pound of Magnesia . . . . .	0 4 0
Seven pound of Epsom Salt . . . . .	0 3 6
About three quarts of Salt of Tartar . . . . .	0 9 0
Half cwt. of saltpetre . . . . .	1 11 6
Four lbs. of Flour of Brimstone . . . . .	0 1 4
Four lbs. of Alum . . . . .	0 2 6
Fourteen pounds of Pot Ash . . . . .	0 7 0
Two Glass Bottles with ground Stoppers each holding two quarts of Oil of Vitriol quite full . . . . .	0 8 8
Pint of Spirit of Nitre . . . . .	0 3 0
Cart load of Coak . . . . .	0 16 0
Two or three Bushels of Charcoal . . . . .	0 5 0
Specimens of all Metals and Ores and Earths one of Native Iron from Siberia great varieties of Lava and Basaltes from different parts of the world specimens of Coals the different Strata in digging into a well, spars scorsa &c., &c. . . . .	20 0 0

Six or seven hundred Substances liquid and solid of which no account can be given many of them the results of expensive processes . . . . . £20 0 0

About half an ounce of Gold . . . . . 2 5 0

Something more than the same quantity of Silver . . . . . 0 6 0

Half a pound of Platina . . . . . 2 8 0

Three ounces of Phosphorus . . . . . 1 1 0

Three dozen Phosphoric Matches in a tin case . . . . . 0 10 6

Two quarts rectified Spirits of Wine . . . . . 0 6 0

Two ditto frequently distilled by Mr. Parker . . . . . 0 15 0

½lb. of the best red Bark . . . . . 0 3 6

Ten Glass Vessels containing about 30 ounces of water to raise Air in its first production . . . . . 1 0 0

Amount of Chymical Substances . . . . . £57 10 6

Brought forward from fo. the Value and Amount of the Plaintiff's Chymical Substances . . . . . 57 10 6

The like from fo. the value and amount of the Plaintiff's Chymical Apparatus . . . . . 133 10 0

The like from fo. the value and amount of the Plaintiff's Mathematical Instruments . . . . . 53 13 6

The like from fo. the value and amount of the Plaintiff's Optical Instruments . . . . . 59 11 0

The like from fo. the value and amount of the Plaintiff's Electrical Apparatus . . . . . 144 3 6

The like from fo. the value and amount of the Plaintiff's Philosophical Instruments . . . . . 160 16 6

£609 5 0

To be deducted from the above Account for the value and amount of the several following Articles saved wholly or in part by the sd. plt. or since returned to him—viz.:

Part of a Solar Microscope . . . . . £3 3 0

Part of a Planetarium or Orrery . . . . . 0 15 0

Part of a Copper condensing fountain . . . . . 0 5 0

4 3 0

Total value and amount of sd. 5th Schedule . . . . . £605 2 0

(Errors and Omissions excepted.)

The foregoing Schedule Inventory and Appraisement hath been made and taken by Messrs. Nairne and Blunt Mathematical Instrument Makers of Cornhill in the City of London persons of great Eminence Experience and Competent Judgment in all the several above articles which will be

proved on the Tryal of the Cause if necessary and the Articles have been by them all valued and appraised at the prices it will cost the plt. to replace and reinstate them and in the above Valuations allowance has been made for all the Articles saved and returned and for such of them as are but in part demolished.

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#### NOTE.

About three years after the foregoing Inventory was taken, another one was made of the apparatus of the French chemist Lavoisier under circumstances still more melancholy. Lavoisier had already perished on the guillotine (May, 1794), when the Committee of Public Instruction by a decree dated 19 *brumaire, an III.* (Oct. 1794), ordered an inventory of the contents of his laboratory. This was carried out by a commission of eight, including Fourcy and Melan, dealers in chemical glassware, and of which the chief was Nicolas Leblanc, the inventor of the process of manufacturing soda-ash, imperishably associated with his name. Those interested in such matters will find the text of this inventory in the Biography of Leblanc published by his grandson, Aug. Anastasi; Paris, 1884. 12mo.

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n. = note.

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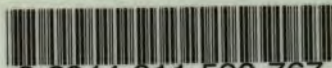
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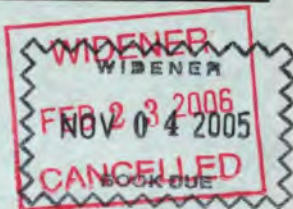


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